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Human Activity and the Environment

A Statistical Compendium



Human Activity and the Environment

A Statistical Compendium

Statistics Canada

Structural Analysis Division
Analytical Studies Branch

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- 123. Regional Industrial Expansion
- 141. Photothèque
- 143. Photothèque
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Preface

The purpose of *Human Activity and the Environment* is to provide a statistical overview of Canada's physical environment with particular reference to the interactions between humans and other elements of the natural system. The compendium focuses on the activities of people in consuming resources, in building and reshaping landscapes, and in generating wastes, as well as on the impacts of these activities on the land, water and air and plants and animals.

Statistics Canada, Environment Canada, and other Federal and Provincial Government agencies collect a large volume of statistical information about human activities and the relationship between people and the physical environment. The data, however, are usually scattered among many separate data bases and publications and are often organized in a fashion which does not readily lend itself to integrated description or analysis of the environment. The data can also be technically complex, and are often difficult to interpret. By bringing together a selection of these statistics and re-organizing them in a way which enhances their value from an environmental perspective, it is anticipated that this information will become more accessible and useful to members of the public who are interested in the environment. At the same time, we believe that *Human Activity and the Environment* will be a useful source book for those who require a guide to more detailed statistics on particular topics.

This is the second publication with this title, the first having been published in 1978. This edition follows a new format and offers expanded coverage of many topics.

Human Activity and the Environment was prepared in the Office of the Senior Adviser on Integration — H.J. Adler, Director, A.M. Friend, Environmental Adviser. The project was managed by Bruce Mitchell.

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Research support services were provided by Elizabeth Scott, Marlene Coulas, Connie Sundin, Shalom Perel, Sheldon Rosenstock and Mabel Fredericks.

A number of Divisions and Subdivisions in Statistics Canada supplied statistics or provided other forms of assistance during the compilation process. These included the Agriculture Division, CANSIM Division, Census Operations Division, Geocartographics Subdivision, Manufacturing and Primary Industries Division, the Small Area Data Program and Transport and Communications Division.

The contributions of Environment Canada and other Federal and Provincial Government agencies who provided data contained herein are gratefully acknowledged. These are credited in the sources on particular tables, charts and maps.

The Geographical Research Division of Energy Mines and Resources Canada played a major role in the preparation of a number of the maps.

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The publication was designed by Rachel Penkar. Diane Joannis coordinated text production. Jacques Fontaine prepared the charts.

Responsibility for the compendium now rests with the Structural Analysis Division — R.B. Hoffman, Director. Comments and inquiries about the publication should be addressed to the Structural Analysis Division, 24th Floor, R.H. Coats Building, Ottawa, Ontario K1A 0T6.

Ivan Fellegi,
Chief Statistician of Canada

Symbols and Abbreviations

..	figures not available
...	figures not appropriate or not applicable
--	amount too small to be expressed
p	preliminary
ppm	parts per million
mg	milligram
ug	microgram
km	kilometre
ha	hectare

Prefixes of the International System of Units

Prefix	Multiplying Factor	
peta	10^{15}	1 000 000 000 000 000
tera	10^{12}	1 000 000 000 000
giga	10^9	1 000 000 000
mega	10^6	1 000 000
kilo	10^3	1 000
hecto	10^2	100
deca	10^1	10
deci	10^{-1}	0.1
centi	10^{-2}	0.01
milli	10^{-3}	0.001
micro	10^{-6}	0.000 001
nano	10^{-9}	0.000 000 001
pico	10^{-12}	0.000 000 000 001

Note:

In some tables, individual items will not add to totals due to rounding.

Table of Contents

			Page				Page
		Introduction	1	Chart	3.1.9	Production of Cattle, 1901 to 1981	72
	1	The Natural Background	9	Chart	3.1.10	Production of Sheep, Horses and Pigs, 1901 to 1981	72
	1.1	Environmental Geography	11				
Map	1.1.1	Ecozones of Canada	13	Chart	3.1.11	Production of Poultry, 1901 to 1981	72
Table	1.1.2	Ecozone Biophysical Characteristics	14	Chart	3.1.12	Production of Selected Major Field Crops, 1923 to 1983	73
Table	1.1.3	Area of Ecozones	15				
Map	1.1.4	Drainage Basins of Canada	16	Table	3.1.13	Production of Selected Major Field Crops by Ecozone, 1971, 1976 and 1981	74
Map	1.1.5	Drainage Basins of Southeastern Canada	17	Chart	3.1.14	Nutrient Content of Fertilizers Sold, 1944 to 1975	75
Table	1.1.6	Drainage Basin Reference Codes and Areas	18	Chart	3.1.15	Sales of Pest Control Products, 1949 to 1975	77
Table	1.1.7	Major Drainage Areas Reference List	20	Table	3.1.16	Agricultural Land Use by Ecozone, 1981	77
	1.2	Physiography and Climate	21	Technical Box	3.1.17	Cropping Practices: An Indicator of Environmental Stress	78
Map	1.2.1	Relief	22				
Map	1.2.2	Soils	23	Table	3.1.18	Cropping Practices by Ecozone, 1981	80
Table	1.2.3	Annual Surface Water Flow Rates of Selected Drainage Basins	24	Map	3.1.19	Wide-Row Cropland as a Percentage of Total Farmland, by Census Division, 1981	81
Map	1.2.4	Growing Degree-Days	25	Map	3.1.20	Close-Row Cropland as a Percentage of Total Farmland, by Census Division, 1981	82
Map	1.2.5	Average Minimum January Temperature	26				
Map	1.2.6	Average Maximum July Temperature	26	Table	3.1.21	Agricultural Land Use by Major Drainage Area, 1981	83
Map	1.2.7	Temperature Range	27				
Map	1.2.8	Precipitation	28	Table	3.1.22	Cropping Practices by Major Drainage Area, 1981	84
Map	1.2.9	Snowfall	29				
Table	1.2.10	Climate Profile of Canada	30	Table	3.1.23	Cropping Practices by Ecozone, 1971, 1976 and 1981	84
	1.3	Major Geophysical and Meteorological Events	33	Table	3.1.24	Monoculture Farms by Ecozone, 1971, 1976 and 1981	86
Map	1.3.1	Earthquake Severity Potential	34	Table	3.1.25	Monoculture Cropland Area by Ecozone, 1971, 1976 and 1981	87
Table	1.3.2	Major Earthquakes	35				
Table	1.3.3	Major Storms	36	Table	3.1.26	Cropping Practices by Major Drainage Area, 1971, 1976 and 1981	88
Table	1.3.4	Major Floods	38				
	2	Population	41	Table	3.1.27	Monoculture Farms by Major Drainage Area, 1971, 1976 and 1981	89
Map	2.1.1	Population and Population Density by Ecozone, 1981	43	Table	3.1.28	Monoculture Cropland Area by Major Drainage Area, 1971, 1976 and 1981	90
Chart	2.1.2	Population by Ecozone, 1981	44	Table	3.1.29	Number of Cattle and Pigs by Ecozone, 1971, 1976 and 1981	91
Table	2.1.3	Population and Population Density by Ecozone, 1971, 1976 and 1981	44	Table	3.1.30	Number of Poultry by Ecozone, 1971, 1976 and 1981	92
Table	2.1.4	Population and Population Density by Major Drainage Area, 1971, 1976 and 1981	46	Table	3.1.31	Number of Cattle and Pigs by Major Drainage Area, 1971, 1976 and 1981	93
Map	2.1.5	Population by Drainage Basin, 1981	47	Table	3.1.32	Number of Poultry by Major Drainage Area, 1971, 1976 and 1981	94
Map	2.1.6	Population Density by Drainage Basin, 1981	48	Table	3.1.33	Fertilizer Application on Farmland by Ecozone, 1970 and 1980	95
Table	2.1.7	Population of American Drainage Basins with Waters Flowing into Canada, 1980	49	Table	3.1.34	Agricultural Pesticide Application on Farmland by Ecozone, 1970 and 1980	96
Table	2.1.8	Population of Major Urban Areas by Ecozone, 1981	50	Map	3.1.35	Kilograms of Fertilizer per Hectare of Farmland, by Census Division, 1980	97
Table	2.1.9	Rural-Urban Population by Major Drainage Area, 1971, 1976 and 1981	51	Map	3.1.36	Percentage of Farmland Sprayed or Dusted with Pesticides, by Census Division, 1980	98
Table	2.1.10	Population of Major Urban Areas by Major Drainage Area, 1981	52				
Table	2.1.11	Experienced Labour Force by Major Drainage Area, 1971 and 1981	54	Table	3.1.37	Fertilizer Application on Farmland by Major Drainage Area, 1970 and 1980	99
Table	2.1.12	Ecozone Socio-Economic Profile, 1971 and 1981	56	Table	3.1.38	Agricultural Pesticide Application on Farmland by Major Drainage Area, 1970 and 1980	100
	3	Harvesting	61	Map	3.1.39	Water Erosion Risk	101
	3.1	Agriculture	63	Map	3.1.40	Wind Erosion Risk	102
Map	3.1.1	Canada Land Inventory Agricultural Soil Capability Classes One, Two and Three	64	Table	3.1.41	Socio-Economic Profile of Persons Employed in Agriculture by Ecozone, 1981	103
Technical Box	3.1.2	Canada Land Inventory Soil Capability Classes	65	Table	3.1.42	Economic Profile of Farms by Ecozone, 1980	104
Table	3.1.3	Canada Land Inventory: Soil Capability for Agriculture	67				
Map	3.1.4	Canadian Agroclimatic Resource Index	68		3.2	Forestry	105
Table	3.1.5	Farms and Farmland, 1901 to 1981	69	Technical Box	3.2.1	Canada's Forest Inventory	106
Chart	3.1.6	Improved Farmland by Region, 1901 to 1981	70	Map	3.2.2	Forest Types, 1981	107
				Map	3.2.3	Area of Stocked, Productive Forestland, 1981	108
Chart	3.1.7	Average Size of Farm by Region, 1901 to 1981	70	Chart	3.2.4	Inventoried Forestland in Relation to Ecozone Area, 1981	109
Table	3.1.8	Indicators of Changing Agricultural Technology, 1901 to 1981	71				

			Page				Page
Table	4.1.1	Productivity and Status of Inventoried Forestland by Ecozone, 1981	110	Table	4.1.4	Production of Selected Non-Metallic Minerals, 1888 to 1982	146
Table	4.1.2	Age Class of Stocked, Productive, Inventoried Forestland by Ecozone, 1981	111	Chart	4.1.5	Production of Selected Non-Metallic Minerals, Twenty-five Year Periods, 1908 to 1982	147
Table	4.1.3	Volume of Softwood Species on Stocked, Productive Forestland by Ecozone, 1981	112	Map	4.1.6	Principal Mining Regions	148
Table	4.1.4	Volume of Hardwood Species on Stocked, Productive Forestland by Ecozone, 1981	113	Technical Box	4.1.7	Non-Renewable Resources and the Measurement of Reserves	150
Table	4.1.5	Forest Harvest by Province, 1954 to 1982	114	Table	4.1.8	Production and Reserves of Metallic Minerals by Ecozone, 1981	151
Table	4.2.1	Annual Forest Harvest, Site Preparation and Planting	114		4.2	Fossil Fuels	153
Chart	4.2.11	Area of Site Preparation as a Proportion of Area Harvested	115	Chart	4.2.1	Domestically Available Energy and Net Energy Imports, 1870 to 1983	154
Chart	4.2.12	Area of Planting and Seeding as a Proportion of Area Harvested	115	Table	4.2.2	Consumption of Energy by Fuel Type, 1870 to 1983	155
Chart	4.2.13	Method of Forest Harvest by Region	116	Table	4.2.3	Consumption of Energy by Sector and Fuel Type, 1983	155
Table	4.2.14	Area of Pest Control on Forestland	116	Chart	4.2.4	Energy Consumed by Sector, 1958, 1972 and 1983	156
Chart	4.2.15	Estimated Forest Loss from Insects and Disease	117	Chart	4.2.5	Energy Consumed in the Transportation Sector, by Mode of Transport, 1958, 1972 and 1983	156
Map	4.2.16	Spread of Dutch Elm Disease in Canada, 1945 to 1982	118	Table	4.2.6	Energy Consumption by Ecozone and Sector, 1982	157
Map	4.2.17	Spruce Budworm Defoliation in Eastern Canada, 1972 and 1981	119	Chart	4.2.7	Energy Consumption per Capita in Selected Countries, 1965 and 1983	158
Map	4.2.18	Tent Caterpillar Defoliation in Canada, 1982	119	Table	4.2.8	Fossil Fuel Production and Consumption, 1868 to 1982	159
Chart	4.2.19	Number of Forest Fires and Area Burned, 1918 to 1983	120	Chart	4.2.9	Production and Consumption of Fossil Fuels, Twenty-five Year Periods, 1883 to 1982	160
Chart	4.2.20	Number of Forest Fires by Cause	121	Table	4.2.10	Estimated Reserves of Conventional Crude Oil, 1960 to 1984	161
Chart	4.2.21	Area Burned by Forest Fires by Cause	121	Table	4.2.11	Estimated Reserves of Natural Gas, 1960 to 1984	161
Table	4.2.22	Socio-Economic Profile of Persons Employed in Forestry and the Logging Industry by Ecozone, 1981	122	Chart	4.2.12	Oil and Gas Depletion Indices	162
	3.3	Fisheries	123	Chart	4.2.13	Oil and Gas Reserves, Life Indices	162
Technical Box	3.3.1	Fish Catch: an Indicator of Fish Stock	124	Map	4.2.14	Oil and Gas Production and Exploration Activities, 1983	163
Map	3.3.2	Northwest Atlantic Fisheries Management Zones	125	Table	4.2.15	Estimated Reserves of Conventional Oil by Ecozone, as of December 31, 1981	164
Chart	3.3.3	Catch by Species Groups in the Northwest Atlantic, 1954 to 1982	126	Chart	4.2.16	Oil Depletion Index by Ecozone, as of December 31, 1981	165
Chart	3.3.4	Canadian Catch by Species Groups in the Northwest Atlantic, 1955 to 1984	126	Table	4.2.17	Estimated Tar Sands Oil Reserves, Alberta Boreal Plain, as of December 31, 1981	166
Chart	3.3.5	Catch of Atlantic Cod in the Northwest Atlantic, 1931 to 1982	127	Table	4.2.18	Estimated Reserves of Natural Gas by Ecozone, as of December 31, 1981	166
Chart	3.3.6	Catch of Atlantic Cod on the Canadian Continental Shelf, 1952 to 1982	127	Chart	4.2.19	Natural Gas Depletion Index by Ecozone, as of December 31, 1981	167
Chart	3.3.7	Catch of Herring in the Northwest Atlantic, 1956 to 1982	128	Map	4.2.20	Coal Mining Activity and Resources, 1983	168
Technical Box	3.3.8	Gulf of St. Lawrence Herring Catch	129	Table	4.2.21	Coal Reserves by Ecozone, 1982	169
Chart	3.3.9	Canadian Invertebrate Catch in the Northwest Atlantic, 1955 to 1984	130	Table	4.2.22	Coal Production by Ecozone, 1981	169
Chart	3.3.10	Atlantic Lobster Catch, 1870 to 1984	131	Table	4.2.23	Socio-Economic Profile of Persons Employed in the Mining and Oil Extraction Industry by Ecozone, 1981	170
Chart	3.3.11	Catch of Salmon in the Northwest Atlantic, 1960 to 1983	132		5	Environmental Restructuring	171
Map	3.3.12	Northeast Pacific Fisheries Management Zones	133		5.1	Land Use and Land Conversion	173
Chart	3.3.13	Catch by Species Groups in the Northeast Pacific, 1955 to 1980	134	Chart	5.1.1	General Land Cover	174
Chart	3.3.14	Canadian Commercial Catch by Species Groups in the Northeast Pacific, 1955 to 1984	134	Map	5.1.2	General Land Cover	175
Chart	3.3.15	Catch of Groundfish in the Northeast Pacific, 1956 to 1983	135	Table	5.1.3	Rural to Urban Land Conversion, 1966 to 1976	176
Table	3.3.16	Commercial Catch of Freshwater Fish 1956 to 1983	136	Table	5.1.4	Agricultural Land Converted to Urban Use, 1966 to 1976	177
Table	3.3.17	Commercial Catch of Freshwater Fish in Ontario, 1962 to 1982	137	Table	5.1.5	Land with High Capability for Agriculture, Forestry, Recreation or Waterfowl Converted to Urban Use, 1966 to 1976	179
Technical Box	3.3.18	Fish Catch: an Indicator of Change in the Great Lakes Ecosystem	138	Map	5.1.6	Canada's Major Fruitlands	181
Table	3.3.19	Persons Employed in the Fishing Industry, 1951 to 1983	139	Table	5.1.7	Population in Major Fruitland Regions	181
Table	3.3.20	Socio-Economic Profile of Fishermen, 1981	140	Table	5.1.8	Major Fruitlands: Area and Number of Trees, 1961 and 1981	182
	4	Extraction and Depletion of Non-Renewable Resources	141	Map	5.1.9	Urbanization in the Niagara Fruitbelt, 1934 and 1975	183
	4.1	Metals and Non-Metallic Minerals	143	Map	5.1.10	Urbanization in the Okanagan Valley, 1966 and 1981	184
Table	4.1.1	Production of Metallic Minerals, 1888 to 1982	144		5.2	Restructuring of Water Systems	185
Chart	4.1.2	Production of Selected Metallic Minerals, Twenty-five Year Periods, 1908 to 1982	145	Table	5.2.1	Large Dams by Major Drainage Area, 1982	186
Chart	4.1.3	Production of Selected Metallic Minerals, Twenty-five Year Periods, 1908 to 1982	145	Map	5.2.2	Large Dam Construction	188

			Page				Page
Table	5.2.3	Major Dams by Ecozone, 1984	190	Table	6.2.13	Pollutants Loadings to Water by Pulp and Paper Mills, by Major Drainage Area, 1973, 1976 and 1982	236
Table	5.2.4	Major Reservoirs by Ecozone, 1984	191				
Map	5.2.5	Major Water Transfers, 1985	192	Table	6.2.14	Water Pollution Compliance Levels of Pulp and Paper Mills, by Major Drainage Area, 1982	237
Table	5.2.6	Major Water Transfers, 1985	193	Chart	6.2.15	Pollutant Loadings to Water by Petroleum Refineries, 1972 to 1980	238
Technical Box	5.2.7	Selected Streamflow Alterations in the Saskatchewan-Nelson Basins	194	Chart	6.2.16	Mercury Loadings to Water by Chlor-Alkali Plants, 1972 to 1983	238
Table	5.2.8	Water Withdrawal and Consumption by Sector, 1981	195				
Table	5.2.9	Water Withdrawal and Consumption, by Major Drainage Area, 1981	195				
	5.3	Transportation Networks	197		6.3	Thermal Energy Generation	239
Chart	5.3.1	Mainline Railroad Track by Region, 1850 to 1981	198	Chart	6.3.1	Generation of Electricity, 1961 to 1982	240
Table	5.3.2	Length of Federal and Provincial Roads and Highways, 1982	199	Table	6.3.2	Generation of Electricity by Province/Territory, 1982	241
Map	5.3.3	Evolution of the Northern Road Network	200	Table	6.3.3	Fuel Consumption by Thermal Generating Stations, 1961 to 1982	241
Table	5.3.4	Aerodromes and Heliports, 1980	201	Table	6.3.4	Fuel Consumption by Thermal Generating Stations, by Ecozone, 1981	242
Map	5.3.5	Major Oil and Gas Pipelines, 1984	202	Table	6.3.5	Consumption of Coal by Thermal Generating Stations and Other Industries, by Ecozone, 1981	243
Chart	5.3.6	Length of Oil Pipelines, 1950 to 1983	203	Technical Box	6.3.6	Composition of Canadian Coals	244
Chart	5.3.7	Length of Natural Gas Pipelines, 1960 to 1983	203	Map	6.3.7	Thermal Electric Generating Stations, 1983	245
Map	5.3.8	Major Electric Transmission Lines	204	Map	6.3.8	Nuclear Generating Stations in the St. Lawrence-Great Lakes Basin, 1984	246
Table	5.3.9	Length of Electric Transmission Circuit by Power Line Voltage, 1956 to 1982	205				
	5.4	Resource Development	207		6.4	Transportation Activity	247
Map	5.4.1	Major Resource Projects	208	Chart	6.4.1	Motor Vehicles, 1910 to 1982	248
Table	5.4.2	Major Resource Projects — Oil and Gas	209	Chart	6.4.2	Railroad and Aircraft Passenger Kilometres, 1940 to 1981	248
Table	5.4.3	Major Resource Projects — Hydro-Electricity Generation and Distribution	210	Chart	6.4.3	Passengers Carried by Transportation Mode, 1974 to 1981	249
Table	5.4.4	Major Resource Projects — Metal Mining	210	Table	6.4.4	Airport Activity: Aircraft Movements by Weight Classes, 1983	250
Table	5.4.5	Major Resource Projects — Industrial Minerals	211	Table	6.4.5	Estimated Population Affected by Aircraft Noise Around Selected Airports, 1976	250
Table	5.4.6	Land Area Utilized by Mining	212	Map	6.4.6	Noise Exposure Forecasts for Ottawa International Airport, 1976 and 1988	251
	6	Generation of Waste Residuals	213	Table	6.4.7	Cargo Movements through Canadian Ports, 1935 to 1983	252
	6.1	Mining	215	Table	6.4.8	Total Cargo and Petroleum Products Handled in Canadian Ports, 1981	252
Table	6.1.1	Mining Activity by Ecozone, 1981	216	Chart	6.4.9	Oil and Gas Movements by Pipelines, 1950 to 1983	253
Table	6.1.2	Mining Activity by Major Drainage Area, 1971, 1976 and 1981	217	Table	6.4.10	Energy Consumed by Transportation Mode, 1958 to 1983	253
Table	6.1.3	Consumption of Fuel and Electricity by Mining Industries, by Ecozone, 1976 and 1981	219	Table	6.4.11	Gasoline Production and Lead Use, 1975 to 1983	254
Table	6.1.4	Consumption of Fuel and Electricity by Mining Industries, by Major Drainage Area, 1976 and 1981	220				
Table	6.1.5	Metal Mining Waste Generation by Ecozone, 1981	221		6.5	Household Consumption and Municipal Wastes	255
Table	6.1.6	Coal Mining Rock Waste Generation by Ecozone, 1981	222	Table	6.5.1	Population Served by Municipal Wastewater Treatment Systems, by Major Drainage Area	256
	6.2	Manufacturing	223	Table	6.5.2	Estimated Daily Waste Discharged from Municipalities by Major Drainage Area	257
Table	6.2.1	Manufacturing Activity by Stressor Type: Stress to Air, 1971, 1976 and 1981	226	Table	6.5.3	Private Occupied Dwellings by Principal House Heating Fuel, by Ecozone, 1981	258
Table	6.2.2	Manufacturing Activity by Stressor Type: Stress to Water, 1971, 1976 and 1981	226	Technical Box	6.5.4	Major Air Contaminant Emissions from Residential Heating, 1980	259
Table	6.2.3	Manufacturing Activity by Ecozone, 1981	227	Table	6.5.5	High Energy Consuming Household and Recreational Goods, 1960 to 1984	259
Table	6.2.4	Manufacturing Activity by Stressor Type: Stress to Water, by Major Drainage Area, 1973, 1976 and 1981	228				
Map	6.2.5	Production Workers in High Stressor Manufacturing Industries, by Drainage Basin, 1981	230		6.6	Multiple Source Stress	261
Table	6.2.6	Consumption of Fuel and Electricity by Manufacturing Industries, by Ecozone, 1976 and 1981	231	Technical Box	6.6.1	Energy Intensity of Industrial Processes: an Indicator of Environmental Stress	262
Table	6.2.7	Consumption of Fuel and Electricity by Manufacturing Industries, by Major Drainage Area, 1976 and 1981	232	Map	6.6.2	Magnitude and Distribution of Sulphur Dioxide Emissions, 1978	264
Table	6.2.8	Heavy Metals: Major End Use by Manufacturing Industries, 1961 to 1982	233	Map	6.6.3	Magnitude and Distribution of Nitrogen Oxides Emissions, 1978	264
Chart	6.2.9	Lead Used by Manufacturing Industries, by Major Drainage Area, 1981	233	Map	6.6.4	Magnitude and Distribution of Hydrocarbon Emissions, 1978	264
Table	6.2.10	Manufacturing Water Use by Industry Group, 1981	234	Map	6.6.5	Magnitude and Distribution of Carbon Monoxide Emissions, 1978	264
Table	6.2.11	Manufacturing Water Use by Major Drainage Area, 1976	235	Map	6.6.6	Magnitude and Distribution of Particulate Matter Emissions, 1978	264
Chart	6.2.12	Hazardous Waste Generated by Manufacturing Industries	235	Table	6.6.7	Trends in Emissions of Sulphur Dioxide	264
				Table	6.6.8	Trends in Emissions of Nitrogen Oxides	264
				Chart	6.6.9	Sources and Emissions of Lead to the Atmosphere, 1978	268

			Page				Page
Table	6.6.10	Annual Air Quality Index for Selected Locations in Canadian Cities, 1974 to 1983	268	Map	7.2.2	PCB Residues in Spottail Shiners from Selected Great Lakes Sites	315
Technical Box	6.6.11	National Air Quality Objectives	269	Map	7.2.3	DDT Residues in Spottail Shiners from Selected Great Lakes Sites	316
Chart	6.6.12	Trends in Selected Air Pollutants in Toronto, Montréal and Vancouver	270	Chart	7.2.4	DDT and PCB Residues in Spottail Shiners from Selected Niagara River Sites	317
Technical Box	6.6.13	Water Quality and the National Water Quality Data Bank	271	Map	7.2.5	DDT and PCB Residues in Herring Gull Eggs from Selected Great Lakes Nesting Colonies	318
Map	6.6.14	Detection of the Herbicide 2,4-D in Prairie Rivers (from NAQUADAT Monitoring Stations), 1980 to 1982	272	Table	7.2.6	DDT and PCB Residues in Atlantic Seabird Eggs	319
Map	6.6.15	Phosphorus in Canadian Rivers (from NAQUADAT Monitoring Stations), 1971 to 1973	273	Map	7.2.7	Dioxin Concentrations in Herring Gull Eggs from Selected Great Lakes Nesting Colonies, 1980 to 1984	320
Map	6.6.16	Phosphorus in Canadian Rivers (from NAQUADAT Monitoring Stations), 1980 to 1982	274	Map	7.2.8	Dioxin Residue in Spottail Shiners from Selected Niagara River Sites, 1981	321
Chart	6.6.17	Distribution of Phosphorus Loadings Relative to Great Lakes Volume, 1982	275	Technical Box	7.2.9	Mercury Contamination in Biota: an Indicator of Environmental Response	322
Table	6.6.18	Phosphorus Loadings to the Great Lakes, 1976 to 1982	276	Chart	7.2.10	Mercury Concentration in Walleye in the English-Wabigoon River System, 1970 to 1981	323
Chart	6.6.19	Lower Great Lakes Municipal Phosphorus Loads, 1972 to 1983	277	Table	7.2.11	Mercury Concentration in Walleye in Lake St. Clair and Lake Simcoe, 1970 to 1983	324
Chart	6.6.20	Phosphorus Concentrations in Lake Ontario, 1970 to 1982	278	Table	7.2.12	Mercury Concentration in Walleye in Lakes of the Prairie Provinces, 1971 to 1983	324
Map	6.6.21	Nutrient Enrichment of the Great Lakes	279	Table	7.2.13	Mercury Concentration in Walleye and Pike in Québec Drainage Basins, 1979	325
Map	6.6.22	Lakes in the Okanagan Drainage Basin	279	Table	7.2.14	Mercury Concentration in Fish from the Fraser River, 1980	325
Table	6.6.23	Phosphorus Loadings to Okanagan Drainage Basin Lakes, 1970 and 1980	280	Map	7.2.15	Acidity of Atlantic Salmon Rivers in the Maritime Provinces	326
Table	6.6.24	Phosphorus Concentrations in Okanagan Drainage Basin Lakes, 1970 to 1980	280	Chart	7.2.16	Angling Catch of Atlantic Salmon in Twenty-two Nova Scotia Rivers by Level of Acid Stress, 1940 to 1980	327
Map	6.6.25	Acidity of Precipitation in the United States and Canada, 1981	281				
Map	6.6.26	Sulphate Deposition and Sensitivity of Waters to Acid Precipitation in Eastern Canada	282				
Table	6.6.27	Surface Water Area by Potential to Reduce Acidity and Sulphate Deposition in Eastern Canada	283		8	Collective and Individual Human Responses	329
Map	6.6.28	Eastern Canada Sulphate Deposition Study Area	283	Table	8.1.1	Selected Government Expenditures on the Environment, 1970 to 1980	331
Table	6.6.29	Spills of Hazardous Materials by Source, 1974 to 1979	284	Table	8.1.2	Accelerated Capital Cost Allowances for Pollution Control Equipment by Industry	331
	7	Biotic State	285	Map	8.1.3	National and Provincial Parks	332
	7.1	Wildlife	287	Table	8.1.4	National Park Profiles	333
Table	7.1.1	Terrestrial Mammal Species by Ecozone	288	Table	8.1.5	Provincial Parks by Ecozone	335
Table	7.1.2	Marine Mammal Species by Ocean	289	Table	8.1.6	Park Area by Ecozone	336
Table	7.1.3	Large Mammal Species by Ecozone	289	Table	8.1.7	Public Perception of the Most Important Environmental Problems at National and Provincial Levels, 1981	337
Map	7.1.4	Mammal Species by Ecozone	290	Table	8.1.8	Public Perception of Pollution Change in Canada	337
Map	7.1.5	Mammal Species by Drainage Basin	291	Table	8.1.9	Public Attitudes Concerning the Management of Forest Resources	338
Table	7.1.6	Breeding Bird Species by Ecozone	292				
Map	7.1.7	Breeding Bird Species by Ecozone	293				
Map	7.1.8	Breeding Bird Species	294				
Map	7.1.9	Distribution of Caribou and Population of Major Herds	295			Appendices	339
Map	7.1.10	Distribution and Population of Polar Bear	296				
Table	7.1.11	Animal Pelts Taken, 1982-1983	297				
Chart	7.1.12	Beaver, Lynx and Muskrat Pelts Taken, 1920 to 1984	298				
Table	7.1.13	Sport and Native Hunting Kills of Large Mammals, by Province, 1983	299				
Chart	7.1.14	Ducks on the Western Plains, 1955 to 1984	300				
Chart	7.1.15	Prairie Ponds, 1955 to 1984	300				
Table	7.1.16	Migratory Birds Killed, by Province, 1983	301				
Table	7.1.17	Waterfowl Killed, by Province, 1967 to 1983	301				
Table	7.1.18	Mammal Species in Jeopardy	302				
Table	7.1.19	Bird Species in Jeopardy	303				
Table	7.1.20	Fish and Reptile Species in Jeopardy	304				
Table	7.1.21	Plant Species in Jeopardy	305				
Table	7.1.22	Non-Native Mammal Introductions	307				

Introduction

The Publication's Purpose

Human activities take place in conjunction with, not in isolation from, the many processes operating in nature. People are only one agent of change in a continually evolving environmental system. However, given the scale of many of the transformations initiated by human activity and the rapidity with which they take place, they tend to produce significant and highly visible impacts on the environment. We depend on the resources of this environment for our continued well-being, and, therefore, have a vested interest in preserving clean air, clean and abundant water, and healthy ecological systems by ensuring that our activities do not impose undue pressures on these elements. Monitoring the stresses our activities place on natural systems and the state of the environment is crucial here because it provides us with the information necessary to prepare appropriate actions to counter undesirable changes.

In Canada, a number of Federal and Provincial government agencies are involved in environmental research and monitoring. Other government departments, most notably Statistics Canada, collect a variety of economic and social information which serve as inputs for environmental studies and which supplement monitoring statistics.

The purpose of this publication is to provide a convenient overview of human activities from an environmental perspective by bringing together a wide variety of statistics from these various government monitoring activities and special studies. Many of these data were drawn from special purpose data bases and technical reports. Assembling these statistics in a compendium makes this information available to a much wider audience.

At the same time, for the person interested in more specific information, *Human Activity and the Environment* can serve as a source book pointing to where more detailed statistics on particular topics can be found.

This publication also illustrates the environmental dimension of certain data series, particularly those of Statistics Canada, which were not originally collected for environmental applications. There are several ways in which this has been done.

First, statistics are reorganized into geographic units which are relevant for studying changes in natural systems; i.e. a wide range of data in this publication is organized by drainage basins and ecozones as well as by provinces.

Second, data are rearranged into categories which detail more clearly the nature of human-environment interactions. For example, the ways in which different crops are grown have some relation to the kind of stresses placed on the environment. As a result, statistics from the Census of Agriculture are regrouped according to cropping practices used by the farmer.

Illustrating the flexibility of the existing data bases may stimulate other researchers to develop further linkages of data for analytical purposes. In-depth analysis, however, was considered to be beyond the scope of this publication.

Organizing Environmental Statistics

The *STRESS*¹ statistical framework provides the organizing principles for this publication. It offers a way of sorting environmental information into a manageable number of groups by categorizing the relationships between humans and the other elements of the ecosystem.²

This framework can be neatly summarized by describing its three basic elements.

The first is that both people and nature are agents of change in the environment. Both human actions and events in nature impose stresses on the environment, that is, create impetus for change in natural systems. These stresses are placed on both the physical (soil, water, air) and biological (animals, plants, humans) elements of the environmental system.

The second major element of the framework is that the components of the environment respond, i.e. change in character, due to these stresses.

The third element is that people have the ability to modify the character and decrease the intensity of the stresses their activities place on the environment.

To illustrate: an industry is located near a river. Wastes are created as by-products of the manufacturing process and these are disposed of by discharging them into the water of the river. Release of these wastes places a *stress* on the water, (i.e. an impetus for change) and results in a modification of the river's physical composition. This change is a physical *response* to the emission of wastes. In turn, this may have an effect on the plants and animals living in the water and might result, for example, in the death of fish. This change in the number of fish is a biotic *response* to the emission of wastes. People may realize that these alterations of the river's characteristics are undesirable because they affect drinking water quality and ultimately human health. Consequently, actions may be taken to modify the stresses which have been created. These actions might include modifying the industrial process or choosing alternative methods of waste disposal.

The *STRESS* framework provides an alternative to more traditional methods of organizing environmental statistics; for example, by media elements, air, water and land, or by activity sectors, agriculture, forestry, fisheries and mining. By integrating the media approach and the activity approach around a

¹ *STRESS* is the acronym for the Stress-Response Environmental Statistical System. For more information refer to: A. Friend and D. Rapport, *Towards a Comprehensive Framework for Environmental Statistics: A Stress-Response Approach*, Catalogue 11-510, Statistics Canada, 1979 and A. Friend, "Conceptual Frameworks and a Unified Approach to Environmental Statistics," in the *Canadian Statistical Review*, Statistics Canada, October 1981.

² Man is in fact seen to be only one of the many elements of this all-encompassing natural system. Kenneth Boulding is one of many who argues that the world must be viewed as a total system of interacting parts and that there is no such thing as an "environment" if that is defined as a natural entity distinct from the human race and its activities. He feels that it makes sense to divide the universe into parts that have some degree of independent dynamic pattern if one keeps in mind that everything is the environment of something else. see K. Boulding, *Eco-dynamics*, Sage Publications, Beverly Hills, California, 1978, page 31.

theme of stresses imposed on the environment and the environment's responses to those pressures, the *STRESS* approach organizes statistics in a way which reflects the dynamic elements of environmental processes. Hopefully, this will contribute to improved data interpretation and the further refinement of indicators of environmental change.

To measure these processes of stress and response, a number of categories of statistics corresponding to the elements of the framework have been established. These are shown in the column headings of Figure 1.

Activity statistics, as the name suggests, provide data about the actions and processes which ultimately generate environmental stresses. The particular sources of stress are termed stressors.

Environmental stress statistics are measures of the pressures placed on the environment by human activities and natural events and processes.

Environmental response statistics are measures of the change in state of physical and biological components of the natural system.

Statistics on collective and individual human responses provide information about actions taken to modify environmental stresses and responses.

In addition to these four categories of data detailing human-environment interactions, are a variety of *measures of stock*. These statistics describe the state of human activities and other physical and biological elements at particular points in time.

The statistics in the framework, and consequently in this publication, are further organized according to the *different kinds of stresses* imposed on the environment. There are five categories of stresses, four of which are directly related to human activities. This reflects the focus of the framework and *Human Activity and the Environment* on human-induced environmental change.

The five categories are presented in the row headings of Figure 1. These groups also serve as the central chapters of this compendium.

They are as follows:

Natural Source Stress: A variety of changes in the environment are brought about by climatic and geophysical events (earthquakes, floods, storms) as well as the long-term processes of climatic and geophysical change.

Harvesting Stresses: This category includes a variety of pressures associated with the removal of biomass from the environment. These items are consumed by people either as food or as inputs for our industries. Included here are forests, other vegetative cover including crops, and stocks of fish and wildlife. Problems occur when the rate of exploitation exceeds the regenerative capability of the resources. In respect to agricultural and forestry activity, problems relating to soil degradation and biomass sustainability are significant.

Extraction and Depletion of Non-Renewable Resources: This category covers the removal from the environment of substances which are finite in supply such as oil, natural gas and other minerals.

Environmental Restructuring: Stresses arise from construction and landscape modification activities. Expansion of cities and settled areas, construction of dams, development of mines and transport networks have direct impacts on wildlife habitat and stream drainage, for example, as well as indirect influences on micro-climates and on water quality.

Generation of Waste Residuals: Wastes are generated as by-products of the industrial and household activities of production and consumption. When these substances are disposed of into air, water or on land, they bring about changes in the physical and chemical characteristics of these media which may, in turn, affect the surrounding flora and fauna, as well as human living conditions.

Organization of the Publication

This publication contains eight chapters. These correspond to the major elements of the *STRESS* framework (see Figure 1).

The first chapter, titled the **Natural Background** deals with natural sources of environmental stress and also provides a variety of information about Canada's physiography and climate.

The second chapter, **Population**, offers information on human population dynamics and distribution as background to subsequent chapters which focus on particular human engendered stresses. Population growth and change is a driving force behind human activities, and ultimately influences the strength and nature of human-induced pressures on the environment.

Chapters Three to Six present the four stress categories — **Harvesting, Extraction and Depletion of Non-Renewable Resources, Environmental Restructuring and Generation of Waste Residuals**. Each of these chapters is further subdivided according to the economic activities imposing these stresses. For example, Chapter Six, **Generation of Waste Residuals**, contains sections on Mining Activity, Manufacturing Activity, Thermal Energy Generation, Transportation, and Household Activities. It also contains a section on environmental stresses which arise from multiple sources.

Chapter Seven, **Biotic State**, presents statistics on environmental response and state. This subject is treated as a separate chapter rather than being integrated within the particular stress chapters as might be expected. Given the current state of environmental response statistics, it is impossible to make the cause-effect links necessary to relate more than a few biotic responses to particular stresses. There are two sections here, one dealing with wildlife populations and the other offering information on contaminants in animals.

The final chapter contains information on **Collective and Individual Human Responses** to environmental problems.

Data Availability and Selection

Early in the process of collecting data for this publication, it became apparent that data availability and quality was extremely uneven and that it would be very difficult to prepare temporally and spatially comprehensive presentations for all subjects. Quality variations and gaps in the environmental data base arise for two reasons: (1) the limits of our understanding of environmental processes and the effects of human activities on them and (2) problems associated with the collection of environmental statistics including the high cost of scientific monitoring. Where data gaps exist, it is often possible to draw upon information from the social and economic statistical spheres to provide a picture of the human-environment interaction process. For many environmental concerns, however, no comprehensive and reliable data are available. Nevertheless, it is hoped that by making these gaps more widely known that interest to develop data for these subjects might be stimulated.

We were generally successful in bringing together many of the statistics sought on human activities. We were less successful in our search for measures of the environmental

Figure 1
The Organizational Framework – STRESS

Stressor Categories	Activity Categories	Activity Statistics ¹	Environmental Stress Statistics ¹	Environmental Response Statistics ¹ (Chapter 7)	Human Response Statistics ¹ (Chapter 8)
Natural Source Stresses (part, Chapter 1)	Geophysical and meteorological events and processes	Floods, storms, earthquakes	Rates of erosion, landscape change	Changes in air, water, soil characteristics Changes in biotic state	Environmental restructuring
Harvesting (Chapter 3)	Agriculture Forestry Fisheries	Production	Changes in soil characteristics Depletion of stocks	Changes in biotic state including population size, regenerative capability	Conservation Changes in methods of farming, harvesting Legislation, fish quotas
Extraction and Depletion of Non-Renewable Resources (Chapter 4)	Metals and non-metallic minerals Fossil fuels	Extraction	Depletion of resources Substitution	Substitution for scarce resources leads to impacts indirectly from wastes and restructuring associated with use of substitutes	Conservation
Environmental Restructuring (Chapter 5)	Land conversion Restructuring water systems Transport networks Resource development	Construction of homes, dams, reservoirs, railways, highways Exploration for resources	Land converted, changed in character	Changes in air, water, soil characteristics (quality) Changes in biotic state including species diversity, population size (due to habitat change)	Changes in rate and location of land conversions Land use legislation Park creation
Generation of Waste Residuals (Chapter 6)	Mining Manufacturing Energy generation Transportation Households	Production Consumption Vehicle movements	Waste generated Emissions of wastes to air, water, soil Disposal of toxics	Changes in air, water, soil characteristics (quality) Changes in biotic state including species diversity, population size Human health effects	Pollution abatement through process change, activity termination Legislation Conservation
Population (Chapter 2) (a background influence)	Population dynamics	Population growth, migration			Population control, resettlement

¹ Examples of kinds of statistics in this category.

stresses brought about by these activities. However, the recasting of available activity statistics into environmentally appropriate geographic or functional classifications contributes to an understanding of these pressures. It was also difficult to compile meaningful presentations in the sections dealing with environmental responses. Human health, for example, is a subject which could have been included in the response section. However, existing data on mortality and morbidity are extremely difficult to relate to effects arising from conditions in the environment with any degree of statistical validity.

Statistics about the environment come from a variety of agencies at the three levels of government and, to a lesser extent, from business and academic sources. Most of these data are collected for purposes other than environmental analysis and tend to be oriented towards the needs of particular programs and policy objectives. For example, even where provincial or municipal statistics exist as in the areas of wildlife populations or land use, lack of comparable classification systems and concepts and differences in survey techniques make it difficult to put together a national presentation.

Approximately fifty percent of the statistics in this publication are derived from Statistics Canada sources and detail human activities which have an effect on the environment. The flexibility and quality of these data enables their recasting along more environmentally meaningful geographic and thematic lines while at the same time maintaining national coverage and definitional consistency.

Data of various kinds about the physical environment have been compiled for many years using solid statistical practices; for example, meteorological records, geological information, and hydrological data. These data provide information on environmental processes and sources of natural environmental stresses.

In the past fifteen years, government efforts to implement environmental protection and conservation policies have focussed attention on data requirements to assess the state of the environment, particularly the quality of water and air. Most of our stress statistics and information on the state of the physical environment come from these sources.

Other statistics, particularly the response data, are derived from collection exercises carried out for very specific purposes, and have very limited geographic, temporal and subject matter coverage. Data of this kind are reliable for the use for which they are collected. For example, scientific detection of the presence or absence of a particular contaminant in fish tissue at a particular site at one point in time may be sufficient for the requirements of regulating that chemical. However, for a broader environmental assessment, additional reliable data on the level of the contaminant from a selection of sites is required.

In the course of compiling this publication, the selection of material to display particular themes was heavily dependent upon the advice of subject matter experts. On their advice a good deal of material which failed to contribute towards providing the broad picture was rejected.

However, a number of somewhat technically complex presentations have been included. In these cases, the analyses and assessments of the experts, as well as information about the methods of data collection, are provided in the footnotes and explanatory notes which accompany the item.

Content Features

Because *Human Activity and the Environment* is primarily a compendium and a source book, extensive analysis of the data was not appropriate here. That task is left to the reader¹.

However, some comments about the statistics are necessary. Discussions of technical considerations are provided to assist the reader in interpreting the statistics. Technical points, whether data collection details, definitions or qualifications, are usually dealt with directly in the relevant table, graph or map either in the footnotes or in more extensive explanatory notes. Most chapters also contain technical boxes which present information to explain the data themselves, the way they were collected or their shortcomings. Technical boxes also present illustrative statistics from limited scientific studies. The technical boxes are shaded to indicate that they are somewhat different from the other material in the publication.

Another purpose served by text is to highlight certain statistics, particularly new data series which appear here for the first time. The summaries which follow provide this brief overview of chapter content and highlight some of the data. This is by no means intended to offer an exhaustive review.

Chapter 1

Natural Background

Environmental Geography: This section introduces two geographic sets, drainage basins and ecozones, which are relevant for the presentation of statistics about the environment. Data are also displayed by provinces, reflecting the complementarity of natural activity space and administrative space and the requirement for information on both geographic bases for environmental assessment.

Physiography and Climate: A selection of information about these two background influences on human activities is presented. Table 1.2.10, the Climate Profile, provides a current summary of climate trends such as extreme heat, extreme cold, snowfall, rainfall, sunshine and growing season duration.

Major Geophysical and Meteorological Events: This section contains information on natural events as sources of environmental stress. These include earthquakes, storms and floods. The summaries were specially compiled from a variety of federal, provincial and private sources.

Chapter 2

Population

Background statistics on population size and distribution by natural and administrative areas are presented here. These compilations highlight the degree to which human settlement is concentrated in a relatively restricted geographic space in Canada. Further, they identify the aquatic and ecological systems experiencing pressures arising from man's activities.

Chapter 3

Harvesting

This is the first of four chapters dealing with human imposed stresses on the environment. It highlights three activities exploiting the renewable resource base, agriculture, forestry and fisheries.

Agriculture: This section begins with an overview of the agricultural resource base, as characterized by land capability information from Environment Canada's Canada Land Inventory, and by the climatic potential for growing crops in different parts of the country.

¹ Statistics Canada has been cooperating with Environment Canada to produce a national report on the state of the environment. *Human Activity and the Environment* and this new report share organizational philosophy as well as some data. *Human Activity and the Environment*, however, contains many detailed presentations while the State of Environment Report will provide an analysis of selected patterns and trends. Thus, the two publications can be viewed as complementary documents.

Following next are historical statistics drawn from the data bases of the Agriculture Division, Statistics Canada. These detail the significant increases in crop and livestock production since the beginning of the century and the corresponding increases in the scale of farm operations, the increasing use of fertilizers and pesticides and the growth of mechanization in the industry.

Tables, Charts and Maps 3.1.17 to 3.1.40 focus on the potential of agricultural activities to stress the environment. The data are largely new tabulations of statistics from several recent Agricultural Censuses. Data retabulations by drainage basins and ecozones point to particular locations where pressures may be arising from farming.

The cropping methods employed in farming dictate the surface area exposed to erosive forces of wind and rain. The use of summer fallowing techniques, that is leaving fields uncropped over the course of a year to build up soil moisture, is believed to result in extensive soil loss from erosion. Significant soil loss is also believed to result from the planting of certain crops such as corn and soybeans with wide separations between the rows. Special tabulations illustrate geographic and temporal cropping practice patterns. These data are complemented by information from Agriculture Canada on erosion risk.

Statistics on applications of fertilizers and pesticides which appear in this chapter could have been placed in the Generation of Waste Residuals Chapter with equal validity. They have been included in this section because their use contributes to the farmer's ability to maintain and increase productivity despite the decline in natural soil fertility that results from intensive agriculture activity.

Forestry: The Canada Forest Inventory, recently established by the Canadian Forestry Service, is the source for much of this section's information. The inventory offers a valuable picture of the distribution, character and state of Canada's forests.

Harvest and forest management statistics which follow the inventory information illustrate cutting, replanting and forest tending activities. Several styles of tree harvesting are used in forestry including clear-cutting and selective cutting. In certain situations clear-cutting seems to result in a significant degree of environmental stress by, for example, contributing to soil erosion problems. The limited data available on method of harvesting are presented here. However, potential exists for future data development in this area by incorporating slope, soil and climate factors with more detailed harvesting statistics.

Maps and Charts 3.2.15 to 3.2.21 portray other sources of stress on the forests including insects, disease and fire.

Fisheries: Overfishing, as well as the impact of other pressures such as pollution and climate change, can create problems for the long-term sustainability of marine resources.

Assessments of fish stocks are almost exclusively derived from fish catch statistics. Data on a variety of species in three aquatic regions, the Atlantic and Pacific Oceans and Inland Waters are included.

Notes at the beginning of the Fisheries section provide more detailed information on the relationship between catch statistics and estimates of stock. Data of these kind are used with other management tools and models by the Department of Fisheries and Oceans to set catch limits, the objective being to sustain the resource.

Chapter 4

Extraction and Depletion of Non-Renewable Resources

This chapter examines the current and historical patterns of mineral extraction with a special focus on the rate of withdrawal in relation to the size of known reserves.

Metals and Non-Metallic Minerals: The data in this section offer a long-term perspective on mineral production in Canada, and illustrate the major increase in the rate of extraction which has taken place in the post war period. In addition, new tabulations present information on the total historical extraction of a number of metals and minerals. A major problem in assessing mineral depletion rates is the difficulty in determining the size of the available resource base. Technical Box 4.1.7 describes the concepts employed by Energy, Mines and Resources Canada in estimating mineral reserves, pointing out that these reserves are as much determined by economic and technical considerations as geological estimates of known quantities.

Fossil Fuels: This section contains statistics on energy consumption as well as information on oil, gas and coal production in Canada. The relation between production and reserves over time and geographic space is also examined for the three minerals.

Chapter 5

Environmental Restructuring

The scope and nature of human activities involved in reshaping the environment for our social and economic well-being are portrayed here in four sections.

Land Use and Land Conversion: Land use statistics are not as well developed in Canada as in many other industrial countries perhaps because of the apparent territorial wealth of the country. This is deceptive, however, because important land based activities such as agriculture are severely restricted by climate and soil quality. Canada's good farmland, soils with moderate or no limitations for the growing of crops, account for only forty-three percent of all agricultural land, which in turn accounts for only eleven percent of Canada's land surface. In fact, the total area of our best land, Canada Land Inventory, class 1 (no cropping limitations) is less than the amount of land of equivalent quality in the State of Ohio.

This section focuses on the state of special lands such as high quality agriculture lands in heavily settled areas and the limited areas of land suitable for fruit growing. Information on land use change in urban areas is derived from special studies by the Lands Directorate, Environment Canada, while many of the fruitland statistics are the result of new tabulations. Two special studies of land conversion in the Niagara and Okanagan fruitlands complete the section.

Restructuring of Water Systems: Dam and reservoir construction and the rerouting of drainage systems are two of the methods by which aquatic systems are changed. Benefits derived include hydro-electric power, flood control, improved navigation, and improved water supplies.

On the negative side, however, valley bottoms, often prime wildlife habitats are flooded, and changes in water flow rates may have impacts on wildlife habitats downstream. This, for example, occurred in the Athabaska Delta of the Peace River after the Bennett Dam was constructed. Water transfers across basin boundaries may introduce new and undesirable species to those areas. For example, in the 1800s Lamprey were

believed to have been introduced to the Upper Great Lakes after the construction of the Welland Canal.

Tables 5.2.1 and Map 5.2.2 portray new compilations of large dams in Canada by drainage basins. The maps clearly indicate the move northward of dam building activities over time. Table 5.2.4 on reservoir construction and the amount of land flooded highlights the extent to which valley bottoms, often prime wildlife habitat, have been lost, especially in the past twenty-five years. Technical Box 5.2.7 illustrates the stream flow effects of river system modifications.

Transportation Networks: The construction of rail lines, roads and airports has a direct impact on land use patterns. More importantly, however, are the indirect effects which may be brought about by the expansion of transport networks. The improved accessibility offered by new transport routes stimulate the development of a variety of other human activities, such as forestry and mining, particularly in remote northern areas. These newly introduced activities may then place their own particular stresses on local environments. Map 5.3.3 illustrates the northern expansion of the road network.

Resource Development: This section provides a summary of information from the Major Projects Inventory maintained by the Department of Regional Industrial Expansion. This includes resource development projects currently under construction or planned. The tables portray the location and scale of potential environmental impacts. The estimated capital cost provides a rough indicator of the project size.

Chapter 6

Generation of Waste Residuals

The generation of wastes is the inevitable by-product of production and consumption activity. The objective of this chapter is to abstract from the economic activity base those statistics relevant for analyses of environmental pollution. This includes, where available, data on pollutant emissions to air and discharges to water. This is the largest chapter in the compendium and contains five activity sections plus a section dealing with environmental stresses from multiple sources.

Mining: Mining activity produces large amounts of waste rock which can contribute to water, air and land pollution. In addition, the consumption of fossil fuels and the activities of smelters result in emissions to the atmosphere. The environmental stress potential of mining activity is portrayed through production statistics such as numbers of workers and fossil fuels purchased. The detailed statistics on generation of rock wastes offer more direct measures of stress.

Manufacturing: Manufacturing activity statistics are retabulated in this section into three categories according to the degree of stress the activity potentially imposes upon the environment's air or water systems. This work is an extension of the calculations presented for the first time in the earlier edition of *Human Activity and the Environment*. The note at the chapter's beginning discusses this retabulation process in detail.

Items 6.2.12 to 6.2.16 present a variety of stress statistics including pollutant loadings to water bodies by particular industries. Derived from Environment Canada data bases, many of these are new tabulations.

Thermal Energy Generation: The emission of substances such as sulphur dioxide from electric generation stations burning fossil fuels is a major source of environmental stress. The tables and charts illustrate the increasing share of thermal energy in the total Canadian power generation picture and provide information on the types of fuel being used.

Map 6.3.7 is a new compilation which illustrates the size

and distribution of thermal generation stations in Canada.

Nuclear power generation has also become an environmental concern. A number of the tables and charts provide information on power generated from nuclear sources while Map 6.3.8 illustrates the location and capacity of individual plants in the Great Lakes Basin.

Transportation Activity: Large amounts of energy are consumed by the transportation sector, in part due to the sheer size of this country and the great distance between major centres of population. A variety of wastes are emitted, largely to the air, and include carbon monoxide, nitrogen oxides and lead. The section presents a variety of historical statistics on transportation activity followed by a selection of stress related data including information on aircraft noise, energy consumption and the use of lead in gasoline.

Household Consumption and Municipal Wastes: Data in this section are largely new compilations from Environment Canada's MUNDAT data base on municipal waterworks and waste water treatment systems. These data are organized by drainage basin and provide information on population served by type of waste water treatment as well as estimates of municipal pollution loadings to water. These are supplemented by selected data on residential heating and diffusion of "high energy" consuming household and recreational products.

Multiple Source Stress: This section summarizes complex data on pollution loadings and environmental quality. The term multiple source is employed because many environmental stresses are non-specific with respect to the source of stress. This does not mean that a predominant source cannot be identified, for example, sulphur dioxide emissions by thermal power stations, and metal smelting operations. However, particular sources might vary from area to area and many small emission sources can be involved in the overall pollution picture. Also, contaminants may be derived from natural sources, for example, forest fires, volcanic eruptions and dust storms.

The section is introduced by a series of national summary maps of air pollutant emissions compiled from Environment Canada's National Inventory of Emissions of Air Contaminants. Other data on loadings of air pollutants in selected urban areas are summarized by composite air quality indices.

The second part of the section focusses on water quality by abstracting statistics from Environment Canada's National Water Quality Data Base (NAQUADAT). Phosphorous loadings have been focussed on in particular since this is a widely monitored substance and is considered to contribute to serious water quality problems. These compilations are new and are one attempt to develop broadly comparable measures from a data base originally designed for site-specific monitoring.

Information on two high profile environmental issues, acid rain and spills of hazardous substances, complete this section. The acid rain information presents the level of acidic deposition in the context of the sensitivity to acidification of the receiving area.

Chapter 7

Biotic State

The information in this chapter portrays the responses of biological species to the pressures imposed on the environment by human activities and natural processes.

Most of the data are the product of scientific studies and as such tend to be site-specific rather than national in scope. They are also highly variable in terms of geographic and temporal comparability. This is a reflection of the high cost involved in obtaining these kinds of data and the different

purposes for which the information is collected.

Two sections make up the chapter. The first deals with the range, stock and status of wildlife while the second provides an indication of the degree to which contaminants in the environment have been picked up by biota.

Wildlife: Table and Maps 7.1.1 to 7.1.8 present newly compiled information on the range and diversity of bird and mammal species. Following these are recent maps showing distributions and population sizes of two species under varying pressures from human activities, the caribou and the polar bear.

Statistics on fur pelts taken and big game and migratory bird kills are used by wildlife biologists to estimate population sizes and population fluctuations. Tables and Charts 7.1.11 to 7.1.17 present these data. These are accompanied by the current lists of endangered species including comments about the factors which have contributed to the current low population levels in each case. Information on introductions of new species completes the section. Species introductions are actually a source of stress rather than a biotic response. The arrival of new species in new locations often produces changes in resident populations through competition for food and habitat. New species introductions may also have both positive and negative impacts on man's activities.

Contaminants and Biotic Response: Ideally, this section should contain information on the effects of contaminants on population size and biological health (including human health). However, such effects are poorly understood by scientists and therefore few of these data are available. Instead, a carefully selected set of representative information about some of the contaminants most frequently linked to potential problems is presented. Statistics in this section may be difficult to interpret. Nevertheless, they have been used in the past to increase public awareness of the presence in nature of toxic substances produced by human activities, as well as the potential impacts these substances may have on human health. Careful reading of footnotes is important in interpreting the meaning and quality of the biological data contained in this section.

Chapter 8

Collective and Individual Human Responses

This last chapter focuses on the actions of governments and individuals to improve, protect, or conserve the quality of the environment and the natural resource base. These actions have usually been taken in response to stresses on the natural system. The limited data presentation does not reflect the lack of positive steps taken in this domain but rather the scarcity of solid data on public and private expenditures and on the respective actions undertaken by individuals, institutions, industrial enterprises and governments in attaining environmental objectives.

Three types of data included here are: (i) expenditures on environmental protection; (ii) establishment of protected areas (national and provincial parks); and (iii) public perceptions and attitudes about the environment. The table on federal and provincial environmental legislation found in Appendix 8 reveals the wide scope and extensive coverage of the legislative base in the environmental domain.

Appendices

The appendices present additional details for a selection of variables for which summary information appeared elsewhere in the publication. For example, due to space considerations in the main body of the publication, drainage basin statistics are presented for basin aggregations called major drainage areas. The appendices contain the more detailed statistics for individual basins, as well as the provincial breakdowns. Statistics which appear by major drainage areas in the chapters but which are not disaggregated in the appendices are available by special request. There are eight appendices, each one corresponding to the chapter of the same number.

1

The Natural Background



Contents

1.1	Environmental Geography	11
1.2	Physiography and Climate	21
1.3	Major Geophysical and Meteorological Events	33

Tables

1.1.2	Ecozone Biophysical Characteristics	14
1.1.3	Area of Ecozones	15
1.1.6	Drainage Basin Reference Codes and Areas	18
1.1.7	Major Drainage Areas Reference List	20
1.2.3	Annual Surface Water Flow Rates of Selected Drainage Basins	24
1.2.10	Climate Profile of Canada	30
1.3.2	Major Earthquakes	35
1.3.3	Major Storms	36
1.3.4	Major Floods	38

Maps

1.1.1	Ecozones of Canada	13
1.1.4	Drainage Basins of Canada	16
1.1.5	Drainage Basins of Southeastern Canada	17
1.2.1	Relief	22
1.2.2	Soils	23
1.2.4	Growing Degree-Days	25
1.2.5	Average Minimum January Temperature	26
1.2.6	Average Maximum July Temperature	26
1.2.7	Temperature Range	27
1.2.8	Precipitation	28
1.2.9	Snowfall	29
1.3.1	Earthquake Severity Potential	34

1.1

Environmental Geography

Geographic Units for Environmental Statistics

Data to assess the state of the environment is sometimes more pertinent when organized by natural process space rather than by legal/jurisdictional space. In this publication we have introduced two natural spatial units employed in environmental analysis, drainage basins and ecozones.

Drainage basins are water catchment areas delineated by heights of land. These are the natural units for all statistics dealing with water — for direct measures such as stream flow, water use, water quality and associated flora and fauna information as well as indirect measures of human activity as depicted by socio-economic statistics. Although such activities as water use or water pollution can be associated with specific administrative units, their impacts will generally extend to other parts of the drainage basin downstream.

Ecozones are large natural regions delineated by distinctive sets of biotic resources (flora and fauna) and physical resources (soils, bedrock, physiography, climate). Since each ecozone comprises a distinctive assemblage of biophysical characteristics, they constitute large fairly homogeneous geographic spaces which are particularly valuable for monitoring the impact of natural and man-made stress on the environment.

Actions to resolve environmental problems are usually undertaken by political administrations such as municipalities, provinces or countries. Therefore, environmental data by administrative units are of interest for management purposes, planning remedial measures, and assessing the effectiveness of policies. Consequently in this publication each natural unit is usually subdivided into its provincial/territorial components. Thus, provincial/territorial statistics by natural units can be obtained by regrouping the drainage basin or ecosystem components (for example drainage basins in Manitoba).

Drainage Basins

The drainage basin classification presented here is consistent with the system used by the Water Survey of Canada, Environment Canada¹. Drainage systems can be differentiated by the natural hierarchy of stream branching. Canada is part of the North American continental hydrological system of which five basins at the apex of the hierarchy are found in Canada. These are: (i) Atlantic Ocean Basin, (ii) Hudson Bay and Ungava Bay Basin, (iii) Arctic Ocean Basin, (iv) Pacific Ocean Basin and (v) Gulf of Mexico Basin. In the case of the latter, a small area of the Mississippi-Missouri system extends into the southern portion of Alberta and Saskatchewan.



The drainage basin classification here is an expanded version of the set originally published in the 1978 edition of *Human Activity and the Environment*. The major concern in developing the classification system (and the associated data base) was its relevance for statistical analysis of the environmental impact of human actions on Canada's water resources and aquatic ecosystems. These areas were delineated from basic units referred to as sub-sub-basins in the Environment Canada classification. In areas with a high intensity of human activity such as the Toronto or Montreal area, the sub-sub-basin was retained. In areas with more or less continuous settlement and moderate population densities such as the Lower Ottawa River, several sub-sub-basins were aggregated. In areas of discontinuous settlement the basins correspond to the sub-basins of the Environment Canada classification and in sparsely settled Northern Canada, combinations of sub-basins are used.

Statistics are displayed for up to eighty-eight drainage basins which are further subdivided into provincial/territorial components.

Many tables present statistics for major drainage areas. These are groups of drainage basins and are designed for the illustration of broad patterns at a national scale. Data displayed by major drainage areas are usually available in the Appendix at the more detailed basin level, or otherwise upon request. It should be noted that any basin data can be grouped for user-specified areas or sorted by province.

Ecozones

The ecozones presented here were delineated by Lands Directorate of Environment Canada. (see Table 1.1.2 for a brief description of ecozone biophysical characteristics).

Ecological land classification is a process of identifying areas which can be viewed as discrete systems with regard to the interplay of the landform, water, soil, vegetation, climate, wildlife and human factors which may be present. These can be further developed into a hierarchical system ranging from site-specific ecosystems (e.g. ponds, woodlots and meadows) to ecological zones encompassing large portions of the earth's surface (e.g. tundra, boreal forests, grasslands, deserts).

The Canada Committee on Ecological Land Classification has proposed a seven level hierarchy, ranging from the eco-

element, a small area with specific characteristics, to eco-provinces and ecozones, generalized ecological units covering very large areas.

Ecological areas have been mapped at the more detailed level in various parts of Canada including Alberta, Québec, Saskatchewan, Yukon and the Northwest Territories. The ecozone classification here is one of the first attempts at a Canada-wide approach, although a number of regionalizations of Canada dealing with specific ecosystem elements have been carried out (for example, forest regions, physiographic regions, and wetland regions).

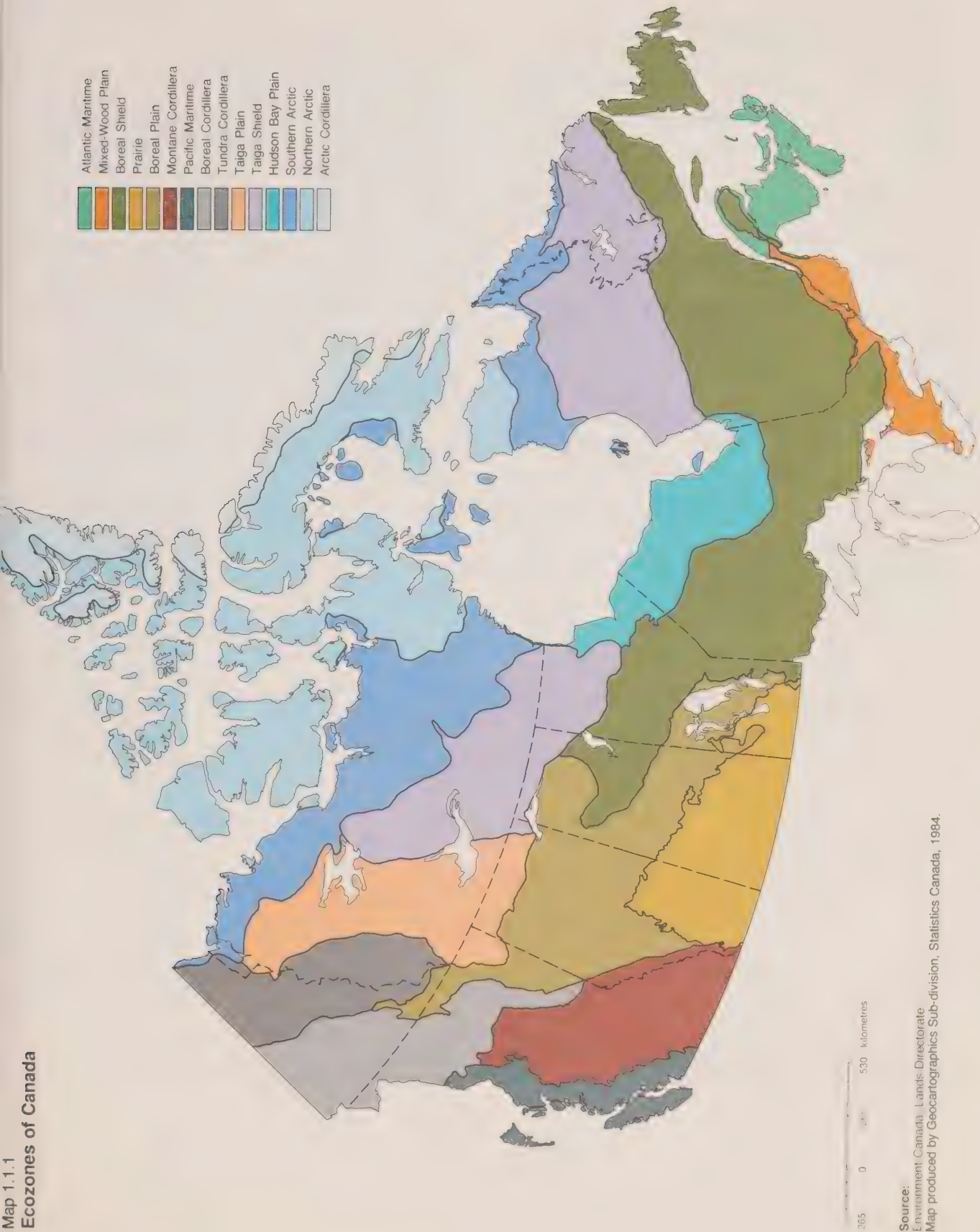
Several organizing conventions were followed by Lands Directorate in delineating these ecozones. Among these is a process termed complexing, which consists of grouping small, spatially proximate units that might otherwise be considered as separate entities. This facilitates examination of patterns at a broad level. The Montane Cordillera Ecozone is illustrative, being composed of many very distinct ecological entities ranging from semi-desert environments, through grasslands and forests to alpine areas.

Another convention followed in delineating boundaries was that in transition areas where classifying elements intermixed, dominant components were identified and their distribution used to assist in placing the boundary line. For example, in southeastern Ontario, a mix of boreal and hardwood forest is present on the Canadian Shield. In this case landform was deemed to have the greatest impact on activities, forest type was disregarded and the boundary of the Boreal Shield was placed to coincide with the southern limit of the Canadian Shield.

Finally, it should be noted that boundary lines often imply a degree of precision in demarcation of ecozones that does not actually exist. More realistically, the boundaries should perhaps be viewed as transition zones ranging from tens to hundreds of kilometres wide depending on the ecozones involved.

The fifteen ecozones presented here are further disaggregated by provinces and territories.

¹ Environment Canada, Inland Waters Directorate, Water Resources Branch, *Hydrometric Map Supplement*, 1977.



Map 1.1.1
Ecozones of Canada

Source:
Environment Canada, Lands Directorate
Map produced by Geocartographics Sub-division, Statistics Canada, 1984.

Table 1.1.2
Ecozone Biophysical Characteristics¹

Ecozone	Physiography	Vegetation	Soils ² and Surface Materials	Climate
Atlantic Maritime	Hills and coastal plains	Mixed broadleaf and conifer stands	Acid and well weathered soils (podzols) and soils with clay-rich sublayers (luvisols), moraine, marine bottom soils and rock debris	Cool to cold winters, mild summers, moderate to heavy precipitation
Mixed-Wood Plain	Plains, some interior hills	Mixed broadleaf and conifer stands	Temperate region soils with clay-rich sublayers (luvisols), marine bottom soils, moraine, rock	Cool to cold winters, warm to hot summers, moderate precipitation
Boreal Shield	Plains, uplands, interior hills, many lakes and streams	Conifer and broadleaf boreal stands	Acid and well weathered soils (podzols), lake bottom soils, moraine, rock	Cold winters, warm to hot summers, moderate precipitation
Prairie	Plains, some foothills	Short and mixed grasslands, aspen parkland	Organically rich, relatively fertile grassland soils (chernozems), moraine and lake bottom materials	Cold winters, hot summers, minimal precipitation
Boreal Plain	Plains, some foothills	Conifer and broadleaf boreal stands	Temperate region soils with clay-rich sublayers (luvisols), moraine and lake bottom materials	Cold winters, warm summers, moderate precipitation
Montane Cordillera	Mountainous highlands, interior plains	Mixed vegetation, conifer stands to sage brush	Temperate region soils with clay-rich sublayers (luvisols), soils with minimal weathering (brunisol), moraine, rock, rock debris	Cool to cold winters, warm to hot summers, arid in lee areas, moist in montane areas
Pacific Maritime	Mountainous highlands, some coastal plains	Coastal western and mountain hemlock	Acid and well-weathered soils (podzols), moraine, rock, rock debris	Mild winters, mild summers, heavy precipitation especially in fall and winter
Boreal Cordillera	Mountainous highlands, some hills and plains	Boreal, some alpine tundra and open woodland	Soils with minimal weathering (brunisol), moraine, rock	Cold winters, mild summers, minimal precipitation in lee areas, moist in montane areas
Tundra Cordillera	Mountainous highlands	Alpine and arctic tundra	Soils with minimal weathering (brunisol), frozen soils (cryosols), moraine, rock	Very cold winters, cool summers, minimal precipitation
Taiga Plain	Plains, some foothills	Open woodland, shrublands and wetlands	Soils with minimal weathering (brunisol), some frozen soils (cryosols), organic materials, moraine	Cold winters, mild to warm summers, moderate precipitation
Taiga Shield	Plains, uplands, some interior hills, many lakes and streams	Open woodlands, some arctic tundra and lichen heath	Soils with minimal weathering (brunisol), acid and well-weathered soils (podzols) some frozen soils (cryosols), moraine, rock	Cold winters, warm summers, moderate precipitation
Hudson Bay Plain	Plains	Wetland, arctic tundra and some conifer stands	Organic soils, sea bottom and beach materials	Cold winters, mild summers, minimal precipitation
Southern Arctic	Plains, some interior hills	Shrub/herb/heath arctic tundra	Frozen soils (cryosols), moraine rock, marine bottom sediments	Cold winters, cool summers, minimal precipitation
Northern Arctic	Plains and hills	Herb-lichen arctic tundra	Frozen soils (cryosols), moraine, rock, marine bottom sediments	Very cold winters, cool summers, minimal precipitation
Arctic Cordillera	Mountainous highlands	Largely non-vegetated, some shrub/herb arctic tundra	Frozen soils (cryosols), rock, rock debris, ice	Very cold winters, cool to cold summers, minimal precipitation

¹ This list is meant to be illustrative only and is not a comprehensive presentation of the characteristics of these areas.

² Cross Reference; refer to Map 1.2.2 (Soils) for a further explanation of soil types.

Source:

Environment Canada, Lands Directorate, *Terrestrial Ecozones of Canada*, by E. Wiken, unpublished working paper, August, 1983.

Table 1.1.3
Area of Ecozones¹

Ecozone	Square Kilometres
Atlantic Maritime	188 810²
Prince Edward Island part	5 660
Nova Scotia part	55 490
New Brunswick part	72 950
Québec part	54 710 ²
Mixed-Wood Plain	194 955³
Québec part	56 935
Ontario part	138 020 ³
Boreal Shield	1 817 845⁴
Newfoundland and Labrador part	122 985
New Brunswick Part	490
Québec part	693 705
Ontario part	652 180 ⁴
Manitoba part	248 455
Saskatchewan part	100 030
Prairie	491 135
Manitoba part	70 715
Saskatchewan part	253 645
Alberta part	166 975
Boreal Plain	882 595
Manitoba part	129 685
Saskatchewan part	258 765
Alberta part	375 850
British Columbia part	93 895
Yukon part	23 975
Northwest Territories part	425
Montane Cordillera	463 300
Alberta part	43 855
British Columbia part	419 445
Pacific Maritime	197 040
British Columbia	197 040
Boreal Cordillera	425 770
British Columbia part	207 535
Yukon part	218 235
Tundra Cordillera	376 960
Yukon part	227 745
Northwest Territories part	149 215
Taiga Plain	557 240
Alberta part	68 090
British Columbia part	29 885
Yukon part	5 485
Northwest Territories part	453 780

Ecozone	Square Kilometres
Taiga Shield	1 301 290
Newfoundland and Labrador part	226 515
Québec part	490 095
Manitoba part	122 630
Saskatchewan part	39 890
Alberta part	6 420
Northwest Territories part	415 740
Hudson Bay Plain	370 820
Québec part	8 625
Ontario part	278 380
Manitoba part	78 665
Northwest Territories part	5 150
Southern Arctic	992 595
Newfoundland and Labrador part	56 220
Québec part	157 360
Yukon part	8 010
Northwest Territories part	771 005
Northern Arctic	1 408 590
Québec part	79 250
Northwest Territories part	1 329 340
Arctic Cordillera	301 665
Northwest Territories	301 665
Canada	9 970 610

¹ These figures include the area of all freshwater in the ecozones.

² This figure includes 34 330 square kilometres of the St. Lawrence River Estuary surface area. The St. Lawrence River Estuary is defined by Inland Waters Directorate, Environment Canada as being that portion of the River between Ile d'Orleans and Anticosti Island.

³ This figure includes 50 515 square kilometres of Great Lakes surface area.

⁴ This figure includes 37 750 square kilometres of Great Lakes surface area.

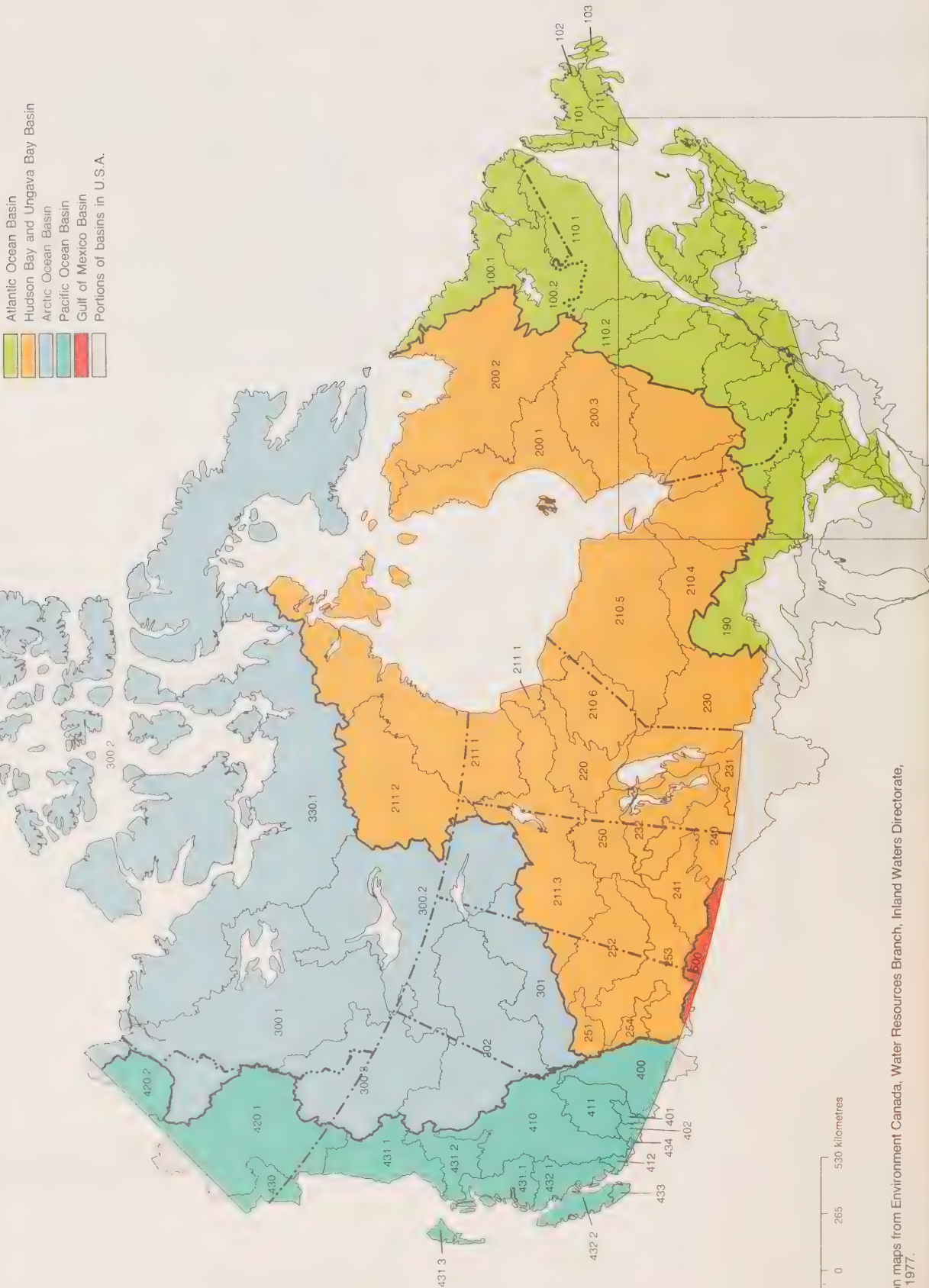
Source:

Statistics Canada, special tabulation; advice provided by Geographical Services Directorate, Energy, Mines and Resources Canada.

Notes:

These data were derived through the use of a computer planimeter. Due to the scale of the maps which were digitized to derive this information, these data should be regarded as estimates only.

- Atlantic Ocean Basin
- Hudson Bay and Ungava Bay Basin
- Arctic Ocean Basin
- Pacific Ocean Basin
- Gulf of Mexico Basin
- Portions of basins in U.S.A.



Map 1.1.4
Drainage Basins of Canada

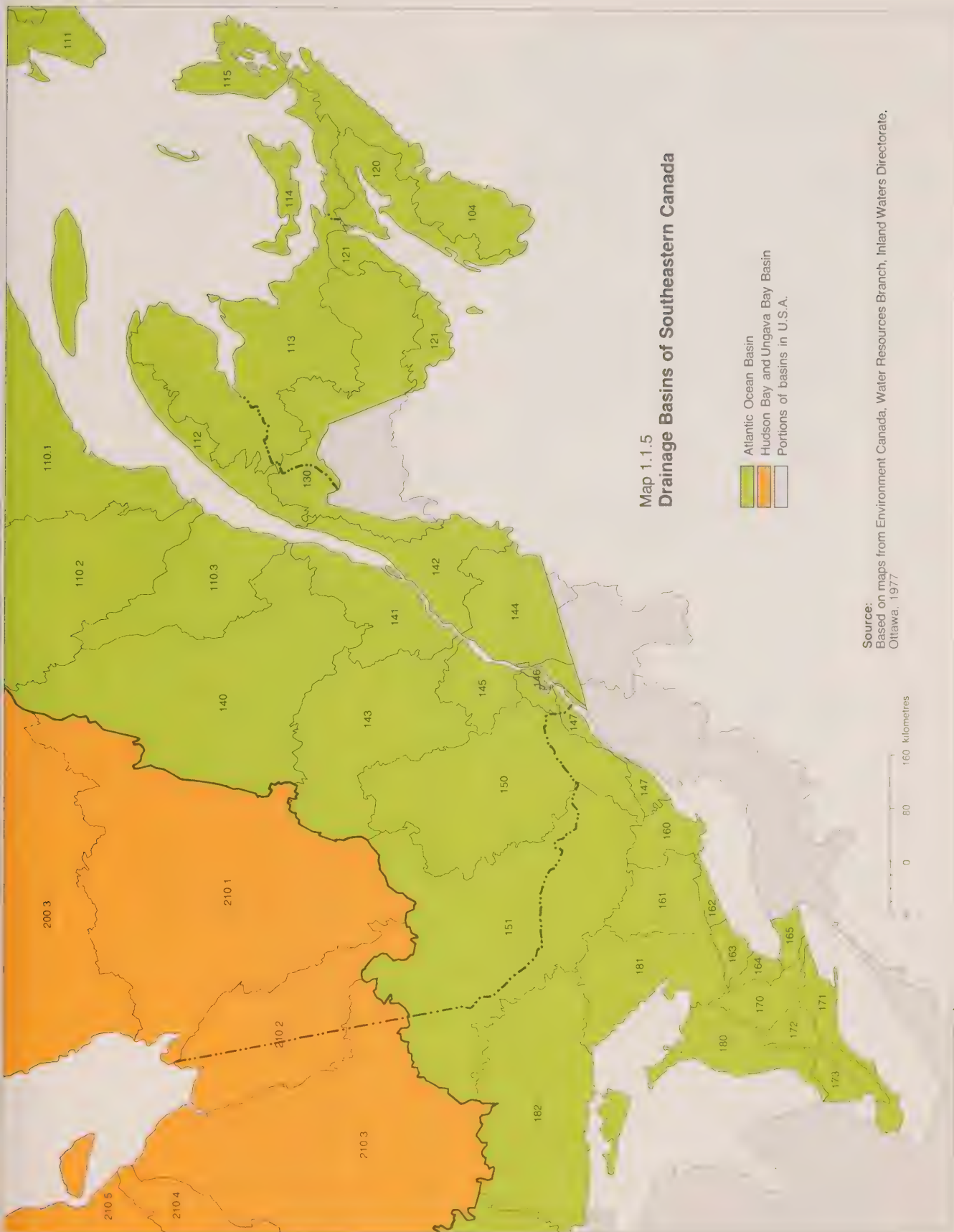


Table 1.1.6
Drainage Basin Reference Codes and Areas¹

			Area in Square Kilometres	Area in Square Kilometres
1. ATLANTIC OCEAN BASIN				
Atlantic Ocean Coastal Drainage				
100.1	- 10	Labrador Coast Rivers	150 230	
100.2	- 10	Churchill and Naskaupi Rivers	110 715	
101	- 10	Newfoundland, North Coast Rivers	48 510	
102	- 10	Trinity Bay Coast Rivers	4 575	
103	- 10	St. John's area Rivers	2 935	
104	- 12	Nova Scotia, Southeast Coast Rivers	23 295	
Gulf of St. Lawrence Coastal Drainage				
110.1		Gulf, Mainland North Coast Rivers:	184 640	
110.1	- 10	Newfoundland (Labrador) part	32 475	
110.1	- 24	Québec part ²	152 165	
110.2	- 24	Manicouagan and Outardes Rivers ²	68 370	
110.3	- 24	Betsiamites River ²	28 915	
111	- 10	Gulf, Newfoundland West and South Coast Rivers	56 280	
112	- 24	North Gaspé Peninsula Rivers ²	12 245	
113		Gulf, Mainland South and West Coast Rivers:	62 860	
113	- 12	Nova Scotia part	7 015	
113	- 13	New Brunswick part	33 610	
113	- 24	Québec part	22 235	
114	- 11	Prince Edward Island Rivers	5 660	
115	- 12	Cape Breton Island Rivers	10 660	
Bay of Fundy Coastal and Saint John River Drainage				
120		Bay of Fundy Coast Rivers:	25 140	
120	- 12	Nova Scotia part	14 520	
121	- 13	New Brunswick part	10 620	
130		Saint John River:	37 450	
130	- 13	New Brunswick part	29 210	
130	- 24	Québec part	8 240	
St. Lawrence River Drainage				
140	- 24	Saguenay River	87 970	
141	- 24	Québec City area - Middle North Shore Rivers ³	20 025	
142	- 24	Chaudière River - Middle South Shore Rivers ³	17 685	
143	- 24	St. Maurice River	45 405	
144	- 24	Eastern Township Rivers - Richelieu River	20 590	
145	- 24	Eastern Laurentian Rivers	9 445	
146	- 24	Montréal area Rivers	4 670	
147		West St. Lawrence River:	4 800	
147	- 24	Québec part	710	
147	- 35	Ontario part	4 090	
Ottawa River Drainage				
150		Lower Ottawa River:	56 070	
150	- 24	Québec part	46 235	
150	- 35	Ontario part	9 835	
151		Upper Ottawa River:	90 615	
151	- 24	Québec part	47 980	
151	- 35	Ontario part	42 635	
Lake Ontario Shore Drainage				
160	- 35	Belleville - Napanee area Rivers ⁴	7 055	
161	- 35	Trent River ⁴	12 815	
162	- 35	Oshawa - Colborne area Rivers ⁴	1 910	
163	- 35	Toronto area Rivers ⁴	3 050	
164	- 35	Hamilton area Rivers ⁴	2 300	
165	- 35	Niagara Peninsula Rivers ⁴	2 565	
Lake Erie and Lake St. Clair Shore Drainage				
170	- 35	Grand River ⁵	7 035	
171	- 35	Lake Erie Shore Rivers ⁵	7 315	
172	- 35	Thames River ⁵	5 800	
173	- 35	Sydenham River ⁵	3 400	
Lake Huron Shore Drainage				
180	- 35	South Huron Shore Rivers ⁶	13 930	
181	- 35	Georgian Bay Shore - Lake Simcoe Shore Rivers ⁶	22 740	
182	- 35	North Huron Shore Rivers ⁶	55 850	
Lake Superior Shore Drainage				
190	- 35	Lake Superior Shore Rivers ⁷	101 795	
2. HUDSON BAY AND UNGAVA BAY BASIN				
Hudson Bay and Ungava Bay Coastal Drainage				
200.1	- 24	East Hudson Bay Coast Rivers	198 075	
200.2	- 24	Ungava Bay Coast Rivers	384 035	
200.3	- 24	Eastmain and LaGrande Rivers	163 430	
210.1	- 24	Rupert and Nottaway Rivers	137 955	
210.2		Harricaw River:	42 615	
210.2	- 24	Québec part	26 320	
210.2	- 35	Ontario part	16 295	
210.3		Moose River:	112 290	
210.3	- 24	Québec part	3 650	
210.3	- 35	Ontario part	108 640	
210.4	- 35	Albany River	100 195	
210.5		Southwest Hudson Bay Coast Rivers:	325 920	
210.5	- 35	Ontario part	304 585	
210.5	- 46	Manitoba part	21 335	
210.6		Hayes River:	107 935	
210.6	- 35	Ontario part	15 880	
210.6	- 46	Manitoba part	92 055	
211.1		West Hudson Bay Coast Rivers:	427 165	
211.1	- 46	Manitoba part	112 455	
211.1	- 47	Saskatchewan part	300	
211.1	- 61	Northwest Territories part	314 410	
211.2		Thelon - Kazan Rivers:	243 935	
211.2	- 46	Manitoba part	795	
211.2	- 47	Saskatchewan part	5 220	
211.2	- 61	Northwest Territories part	237 920	
211.3		Churchill River:	282 520	
211.3	- 46	Manitoba part	93 790	
211.3	- 47	Saskatchewan part	172 780	
211.3	- 48	Alberta part	15 950	
Nelson River Drainage				
220	- 46	Nelson River	90 365	
Lake Winnipeg Shore Drainage				
230		Lake Winnipeg Shore Rivers:	227 845	
230	- 35	Ontario part	130 560	
230	- 46	Manitoba part	97 285	
231	- 46	Red River	25 620	
232		Dauphin River:	83 510	
232	- 46	Manitoba part	65 245	
232	- 47	Saskatchewan part	18 265	
Assiniboine River Drainage				
240		Assiniboine and Souris Rivers:	90 245	
240	- 46	Manitoba part	31 595	
240	- 47	Saskatchewan part	58 650	
241		Qu'Appelle River - Old Wives Lake:	71 600	
241	- 46	Manitoba part	70	
241	- 47	Saskatchewan part	71 530	
Saskatchewan River Drainage				
250		Saskatchewan River:	78 730	
250	- 46	Manitoba part	19 340	
250	- 47	Saskatchewan part	59 390	
251	- 48	Upper North Saskatchewan River	28 065	
252		Lower North Saskatchewan River:	124 750	
252	- 47	Saskatchewan part	57 030	
252	- 48	Alberta part	67 720	
253		South Saskatchewan River and Red Deer River:	152 575	
253	- 47	Saskatchewan part	56 970	
253	- 48	Alberta part	95 605	
254	- 48	Bow River	24 980	
3. ARCTIC OCEAN BASIN				
Mackenzie River Drainage				
300.1		Mackenzie River:	544 765	
300.1	- 60	Yukon part	68 530	
300.1	- 61	Northwest Territories part	476 235	
300.2		Great Slave Lake Shore Rivers:	496 915	
300.2	- 47	Saskatchewan part	114 900	
300.2	- 48	Alberta part	76 265	
300.2	- 59	British Columbia part	8 065	
300.2	- 61	Northwest Territories part	297 685	
300.3		Liard River:	273 915	
300.3	- 48	Alberta part	9 035	
300.3	- 59	British Columbia part	142 545	

Table 1.1.6
Drainage Basin Reference Codes and Areas¹
 (concluded)

		Area in Square Kilometres
300.3 - 60	Yukon part	60 670
300.3 - 61	Northwest Territories part	61 665
301	Athabasca River:	160 690
301 - 47	Saskatchewan part	16 720
301 - 48	Alberta part	143 970
302	Peace River:	319 080
302 - 48	Alberta part	194 040
302 - 59	British Columbia part	125 040
Arctic Ocean Coastal Drainage		
330.1	Mainland Arctic Coast Rivers:	707 725
330.1 - 60	Yukon Part	16 120
330.1 - 61	Northwest Territories part	691 605
330.2 - 61	Arctic Islands Rivers	1 346 800
4. PACIFIC OCEAN BASIN		
Columbia River Drainage		
400 - 59	Columbia River	88 960
401 - 59	Okanagan River	7 820
402 - 59	Similkameen River	7 155
Fraser River Drainage		
410 - 59	Upper Fraser River	172 820
411 - 59	Thompson River	56 570
412 - 59	Lower Fraser River	5 745
Yukon River Drainage		
420.1	Yukon River:	272 985
420.1 - 59	British Columbia part	24 075
420.1 - 60	Yukon part	248 910
420.2 - 60	Porcupine River	61 820
Pacific Ocean, North Coastal Drainage		
430	Alsek River:	38 605
430 - 59	British Columbia part	11 205
430 - 60	Yukon part	27 400
431.1 - 59	Pacific Ocean, North Coast Rivers	154 575
431.2 - 59	Skeena River	55 245
431.3 - 59	Queen Charlotte Islands Rivers	9 695
Pacific Ocean, South Coastal Drainage		
432.1 - 59	Pacific Ocean, South Coast Rivers	44 560
432.2 - 59	Northern Vancouver Island Rivers	27 925
433 - 59	Southern Vancouver Island Rivers	4 850
434 - 59	Skagit River	950
5. GULF OF MEXICO BASIN		
Missouri River Drainage		
500	Missouri Tributary Rivers:	26 135
500 - 47	Saskatchewan part	20 575
500 - 48	Alberta part	5 560

¹ These figures include the area of freshwater in the basins except as noted.

² This basin feeds water to the St. Lawrence River Estuary. The St. Lawrence River Estuary is defined by Inland Waters Directorate, Environment Canada, as being that portion of the River between l'Île d'Orléans and Anticosti Island. The area of the estuary between the height of land separating the Saguenay Basin from the Betsiamites Basin and Anticosti Island is approximately 28,000 square kilometres. This area is not included in the basin totals.

³ This basin feeds water to the St. Lawrence Estuary. The St. Lawrence River Estuary is defined by Inland Waters Directorate, Environment Canada, as being that portion of the River between l'Île d'Orléans and Anticosti Island. The area of the estuary between l'Île d'Orléans and the height of land separating the Saguenay Basin from the Betsiamites Basin is approximately 6,330 square kilometres. This area is not included in the basin total.

⁴ This basin feeds water to Lake Ontario. The area of the Canadian portion of this Lake is 10,050 square kilometres. This area is not included in the basin total.

⁵ This basin feeds water to Lake St. Clair and/or Lake Erie. The area of the Canadian portion of Lake St. Clair is 695 square kilometres and the area of the Canadian portion of Lake Erie is 12,770 square kilometres. These areas are not included in the basin total.

⁶ This basin feeds water to Lake Huron. The area of the Canadian portion of Lake Huron is 36,000 square kilometres. This area is not included in the basin total.

⁷ This basin feeds water to Lake Superior. The area of the Canadian portion of Lake Superior is 28,750 square kilometres. This area is not included in the basin total.

Source:

Statistics Canada, special tabulations; advice provided by Geographical Services Directorate, Energy Mines and Resources Canada.

Notes:

These data were derived through the use of a computer planimeter. Due to the scale of the maps digitized to provide this information, these data should be regarded as estimates only.

The basin codes presented here have two components. The first number is the basin code itself while the second number is the Standard Geographical Classification Code for the Province or Territory. The Provincial and Territorial codes are as follows:

- 10 — Newfoundland
- 11 — Prince Edward Island
- 12 — Nova Scotia
- 13 — New Brunswick
- 24 — Québec
- 35 — Ontario
- 46 — Manitoba
- 47 — Saskatchewan
- 48 — Alberta
- 59 — British Columbia
- 60 — Yukon
- 61 — Northwest Territories

Table 1.1.7
Major Drainage Areas Reference List

Major Drainage Area	Drainage Basin Code
1. Atlantic Ocean Basin	
Atlantic Ocean Coastal Drainage	100.1, 100.2, 101, 102, 103, 104
Gulf of St. Lawrence Coastal Drainage	110.1, 110.2, 110.3, 111, 112, 113, 114, 115
Bay of Fundy Coastal - Saint John River Drainage	120, 121, 130
St. Lawrence River Drainage	140, 141, 142, 143, 144, 145, 146, 147
Ottawa River Drainage	150, 151
Lake Ontario Shore Drainage	160, 161, 162, 163, 164, 165
Lake Erie Shore and Lake St. Clair Shore Drainage	170, 171, 172, 173
Lake Huron Shore Drainage	180, 181, 182
Lake Superior Shore Drainage	190
2. Hudson Bay and Ungava Bay Basin	
Hudson Bay and Ungava Bay Coastal Drainage	200.1, 200.2, 200.3, 210.1, 210.2, 210.3, 210.4, 210.5, 210.6, 211.1, 211.2, 211.3
Nelson River Drainage	220
Lake Winnipeg Shore Drainage	230, 231, 232
Assiniboine River Drainage	240, 241
Saskatchewan River Drainage	250, 251, 252, 253, 254
3. Arctic Ocean Basin	
Mackenzie River Drainage	300.1, 300.2, 300.3, 301, 302
Arctic Ocean Coastal	330.1, 330.2
4. Pacific Ocean Basin	
Columbia River Drainage	400, 401, 402
Fraser River Drainage	410, 411, 412
Yukon River Drainage	420.1, 420.2
Pacific Ocean, North Coastal Drainage	430, 431.1, 431.2, 431.3
Pacific Ocean, South Coastal Drainage	432.1, 432.2, 433, 434
5. Gulf of Mexico Basin	
Missouri River Drainage	500

Notes:

Statistics for drainage basins are available from Statistics Canada at four levels of detail. The most aggregate level is the Major Drainage Area. These units are groupings of the individual Drainage Basins portrayed in Map 1.1.4 and Map 1.1.5. Major Drainage Areas are used extensively in the main body of this publication to provide a general overview of geographic patterns and for the presentation of time series data. The list presented in this table details the constituent basins of each Major Drainage Area.

The second level of detail is the Drainage Basin itself. Some data for these units appear in the body of this publication and much more is to be found in the Appendices, including disaggregations by province. Due to the large number of basins involved, however, only a selection of the available information could be published here. Therefore, a third level of detail available are data for the Drainage Basins which could not be published here due to space constraints but which are on file and are available. Typically, these are data from the 1971 and 1976 Censuses.

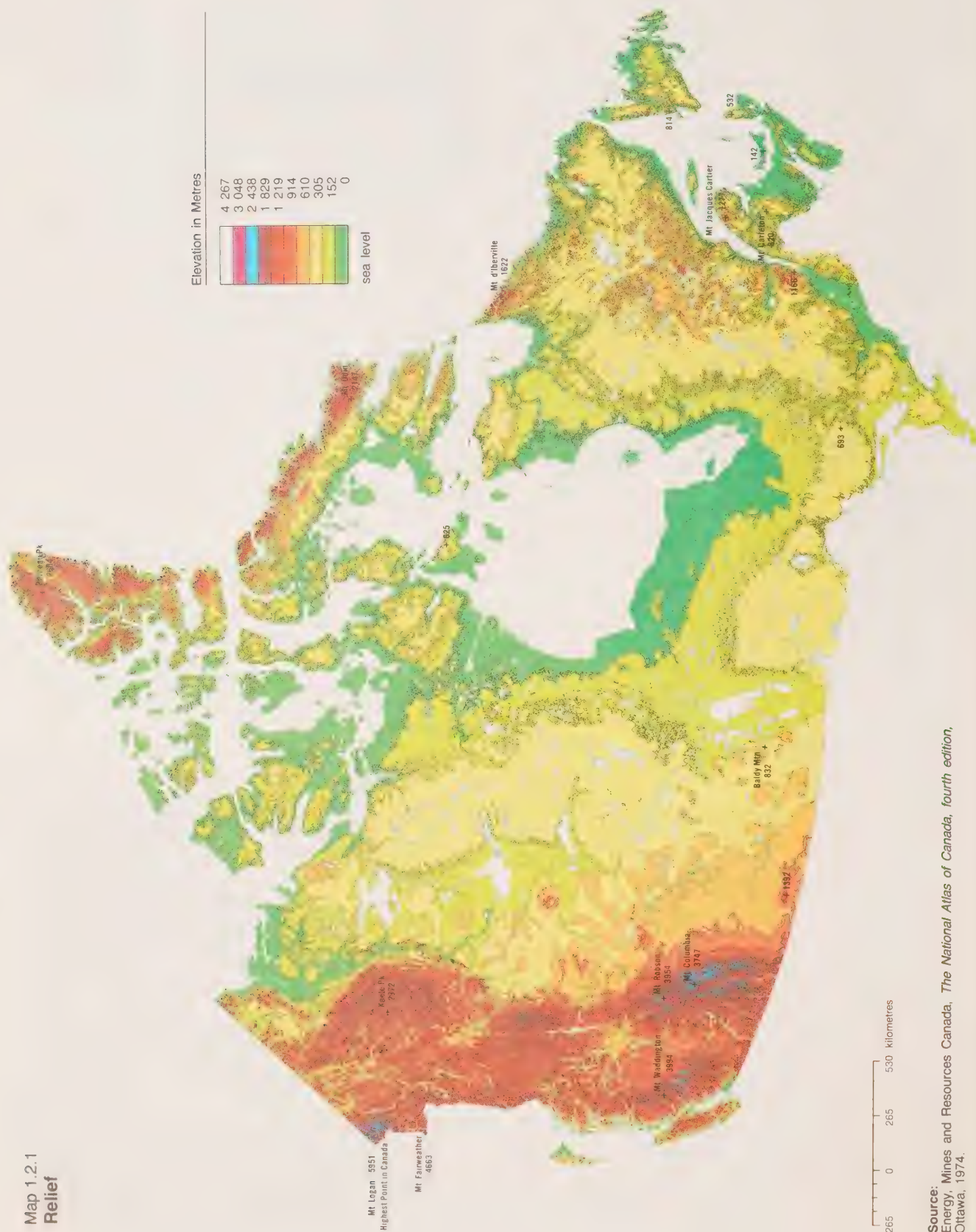
Finally, data are also available on a special request basis. For example, the Drainage Basins presented in this publication could be further disaggregated. Statistics could also be produced for other special user-defined study areas in some cases, work in this area has already been undertaken and data tabulations may be available in an unpublished form. Special tabulations are usually prepared on a cost recovery basis.

1.2

Physiography and Climate



Map 1.2.1
Relief



Source: Energy, Mines and Resources Canada, *The National Atlas of Canada, fourth edition*, Ottawa, 1974.

Map 1.2.2
Soils

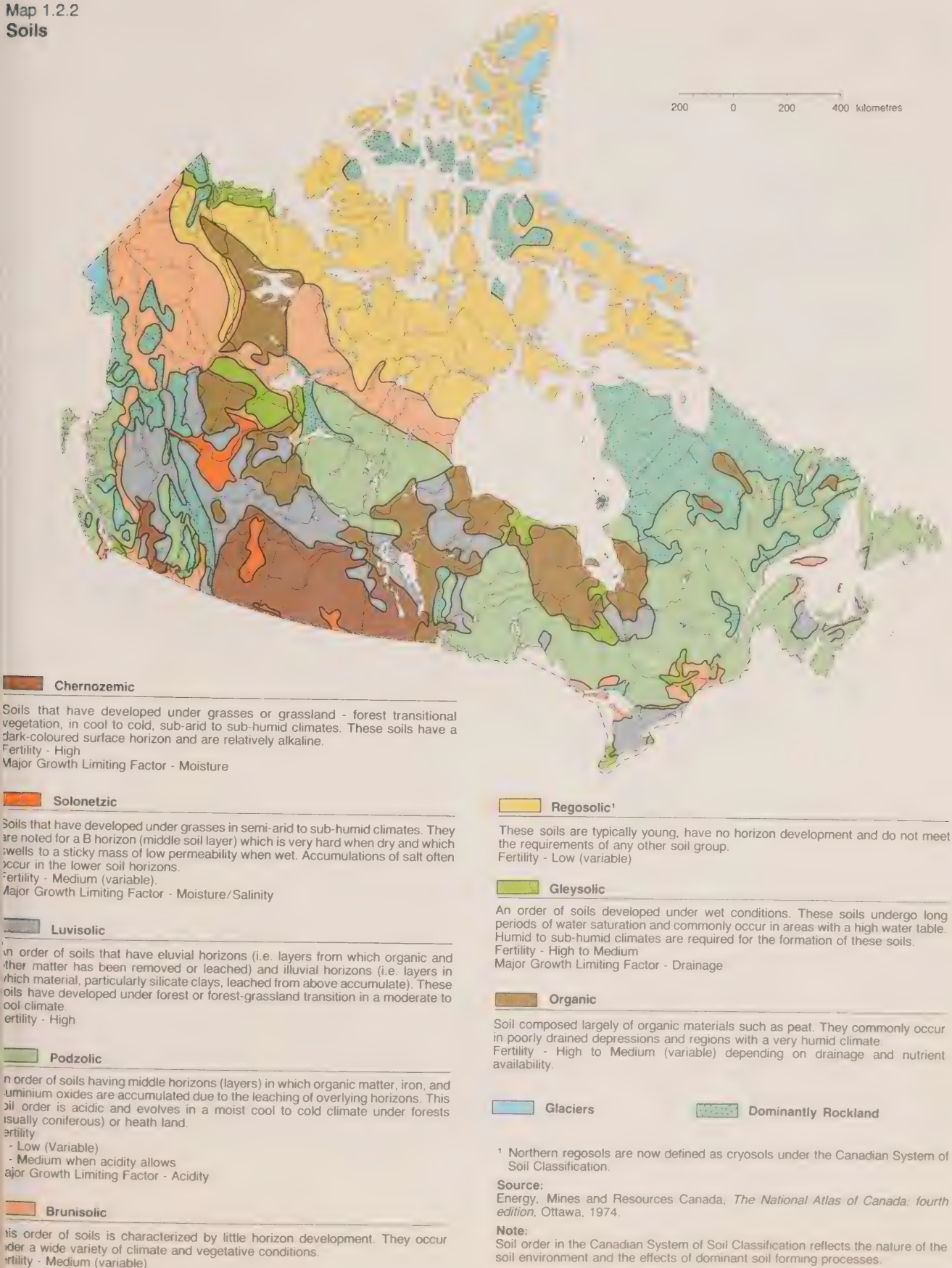


Table 1.2.3
Annual Surface Water Flow Rates of Selected Drainage Basins

Basin	Annual Reliable Flow Rate ¹	Annual Mean Flow Rate	Annual High Flow Rate ²
cubic metres per second			
1. Atlantic Ocean Basin³	21 228	29 087	36 954
150,151 Upper, Lower Ottawa River	1 390	1 990	2 590
160 to 190 Great Lakes Basins ³	2 403	3 067	3 733
2. Hudson Bay and Ungava Bay Basin³	21 634	30 594	39 795
211 Churchill River ⁴	323	701	1 070
231,240,241 Red, Assiniboine, Qu'Appelle Rivers ³	16	50	189
251,252 Upper, Lower North Saskatchewan River	160	234	373
253,254 South Saskatchewan, Red Deer, Bow Rivers ³	147	239	418
3. Arctic Ocean Basin	13 896	20 491	27 089
301,302 Athabasca, Peace Rivers	1 862	2 903	3 946
4. Pacific Ocean Basin³	19 095	24 951	30 795
400 Columbia River ³	1 644	2 009	2 373
401,402 Okanagan, Similkameen Rivers ³	31	74	116
410 to 412 Upper, Lower Fraser, Thompson Rivers	3 044	3 972	4 900
5. Gulf of Mexico Basin³	3	12	41

¹ Flow equalled or exceeded in nineteen out of twenty years.

² Flow equalled or exceeded in only one out of twenty years.

³ Excludes inflow from U.S.A. portion of basin.

⁴ Excludes flow transferred into neighbouring basin(s) by water diversions.

Source:

Environment Canada, Inland Waters Directorate, unpublished information.

Map 1.2.4
Growing Degree-Days



Sources:
Energy, Mines and Resources Canada, *The National Atlas of Canada, fifth edition*, Growing Degree-Days, Ottawa, 1981.
K. Hare and M. Thomas, *Climate Canada*, Wiley, Toronto, 1974.

Note:
This map portrays the geographic differences in heat (energy) availability for plant growth. Growing degree-days, the unit of measurement, is calculated in the following manner. It is assumed that plant growth begins as air temperature rises beyond a threshold of 5°C. For each day that the mean of the hourly air temperature readings exceeds 5°C the value by which it exceeds this number is recorded. The successive daily values are added together to provide the total number of growing degree-days. Temperature normals used for these calculations are based on the climatological recording period of 1941 to 1970. Certain types of crops require greater energy inputs and a longer season than others. The map of growing degree-days illustrates the climatic limitations to agriculture present in much of the country. For example, corn requires much greater energy inputs than barley. Therefore, while it is possible to grow commercially viable crops of barley throughout south and central Canada where soils permit, corn is generally limited to the parts of southern Canada with at least 2 000 growing degree-days, with a substantially higher heat input being desirable.

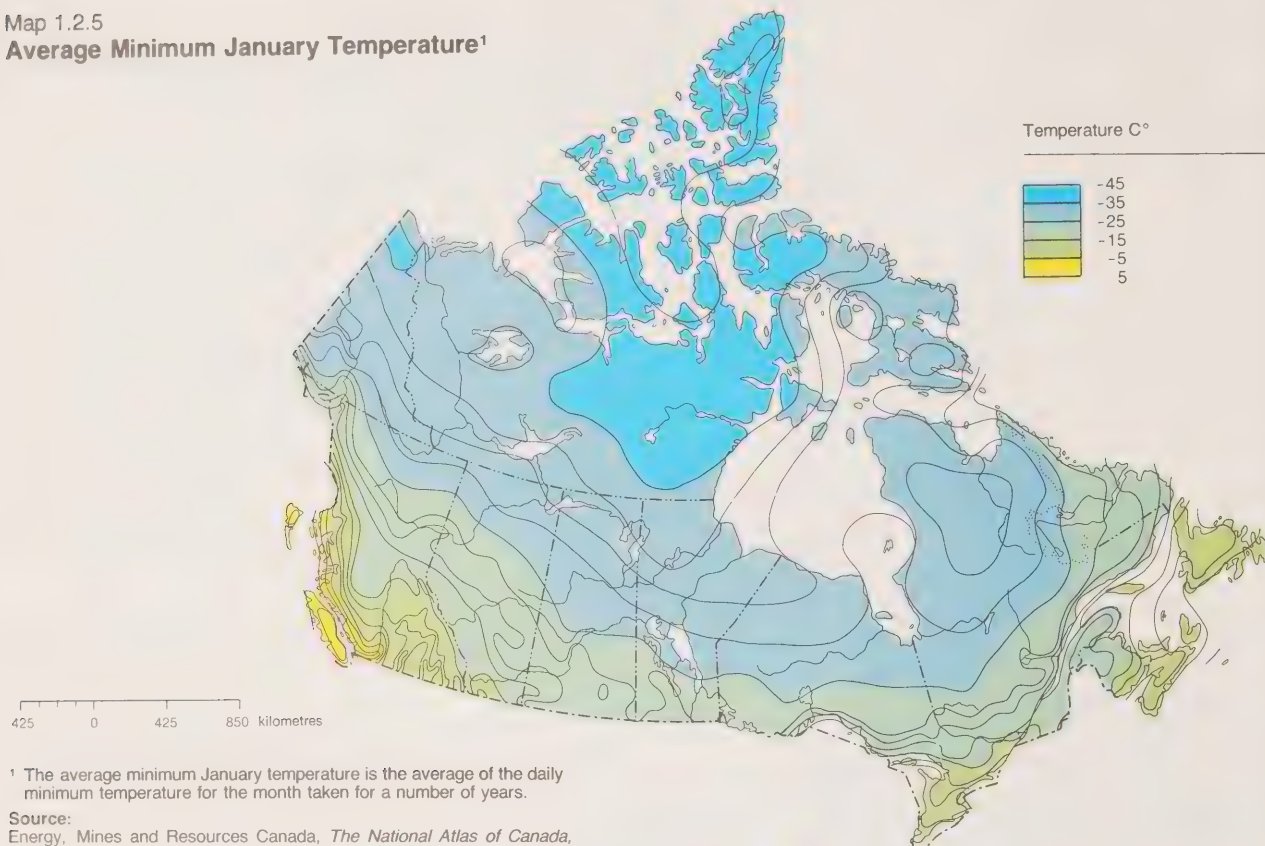
Degree-Days above 5°C (annual normal)

	0- 999
	1 000-1 499
	1 500-1 999
	≥ 2 000

Growing Season: Number of days with an average temperature above 5°C.

Degree-Days: The number of degrees above 5°C accumulated for all days of the growing season.

Map 1.2.5

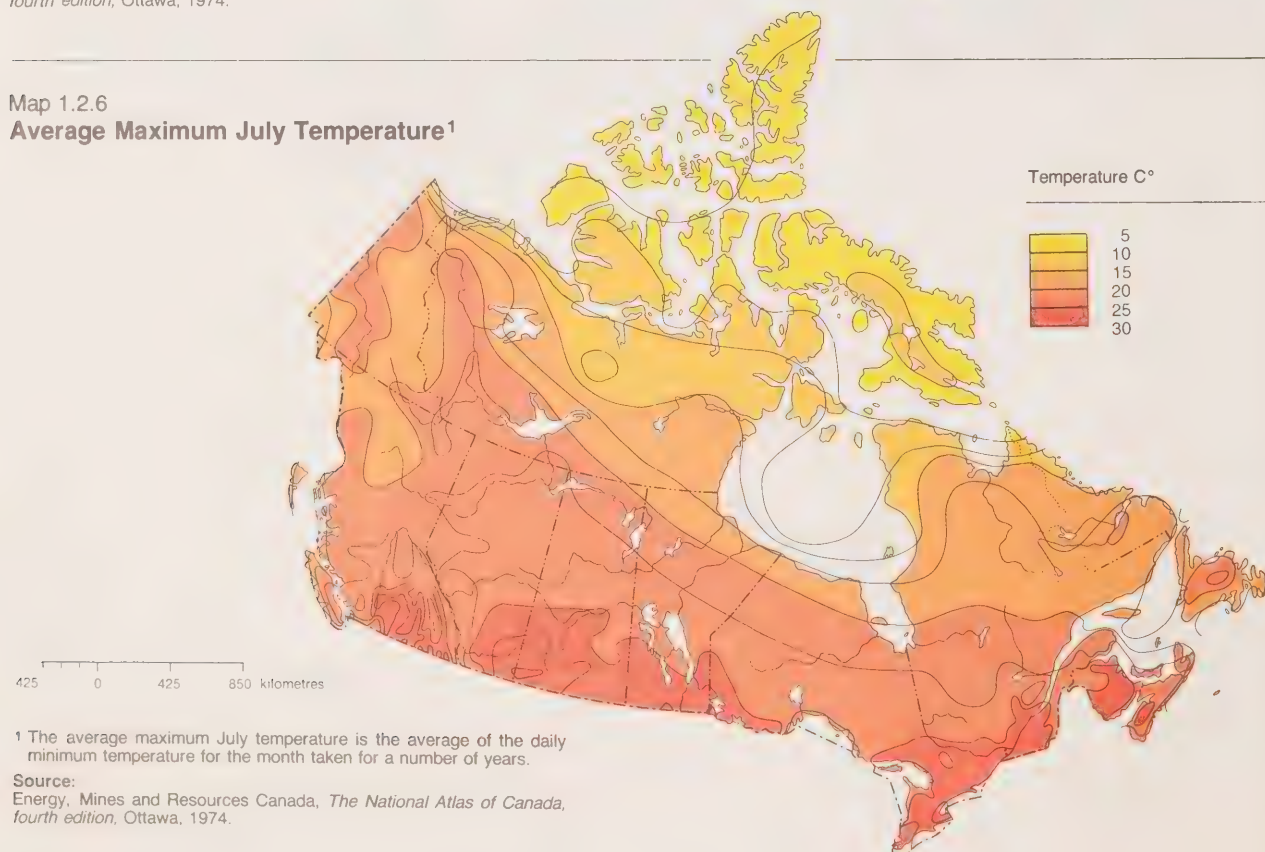
Average Minimum January Temperature¹

¹ The average minimum January temperature is the average of the daily minimum temperature for the month taken for a number of years.

Source:

Energy, Mines and Resources Canada, *The National Atlas of Canada*, fourth edition, Ottawa, 1974.

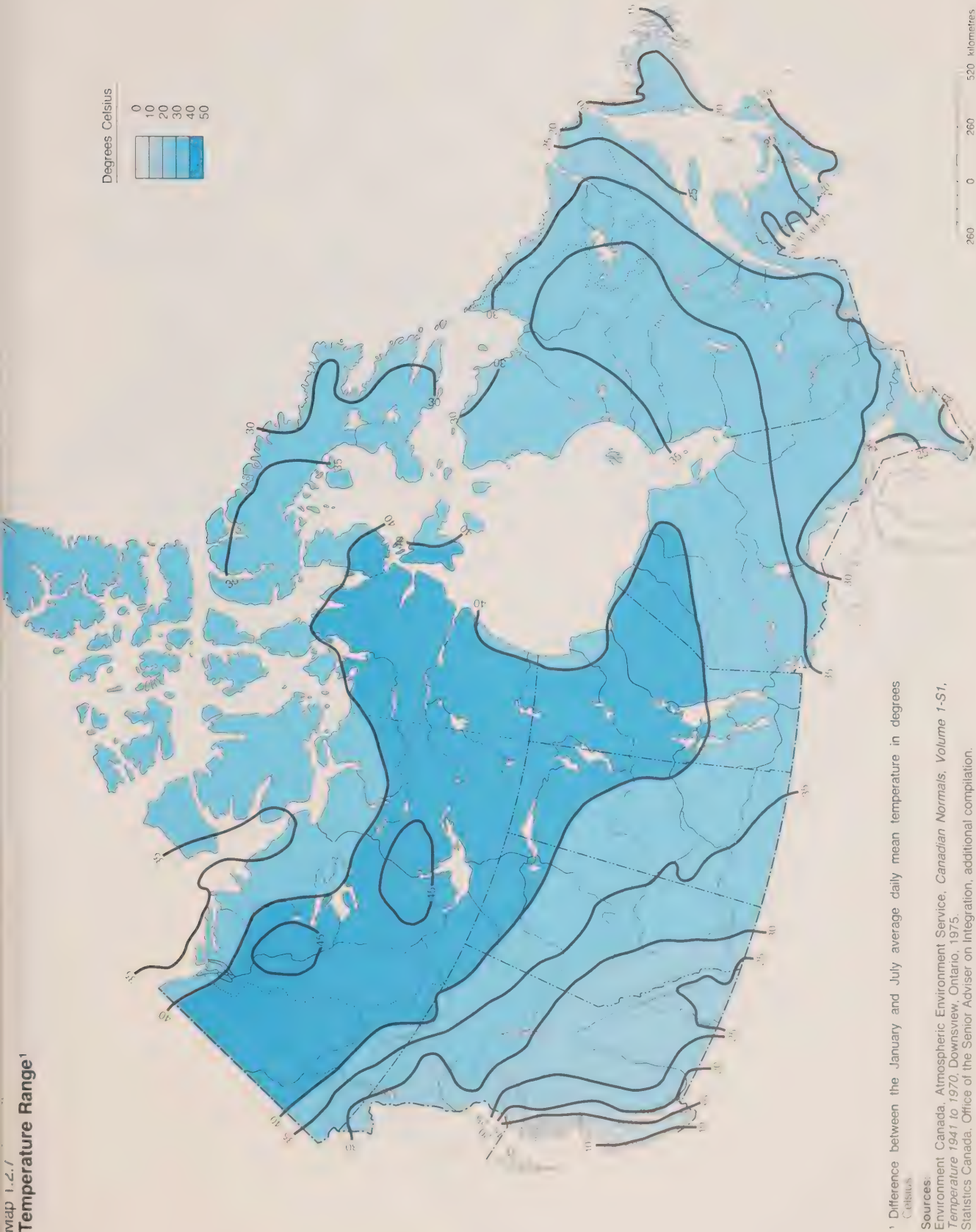
Map 1.2.6

Average Maximum July Temperature¹

¹ The average maximum July temperature is the average of the daily maximum temperature for the month taken for a number of years.

Source:

Energy, Mines and Resources Canada, *The National Atlas of Canada*, fourth edition, Ottawa, 1974.

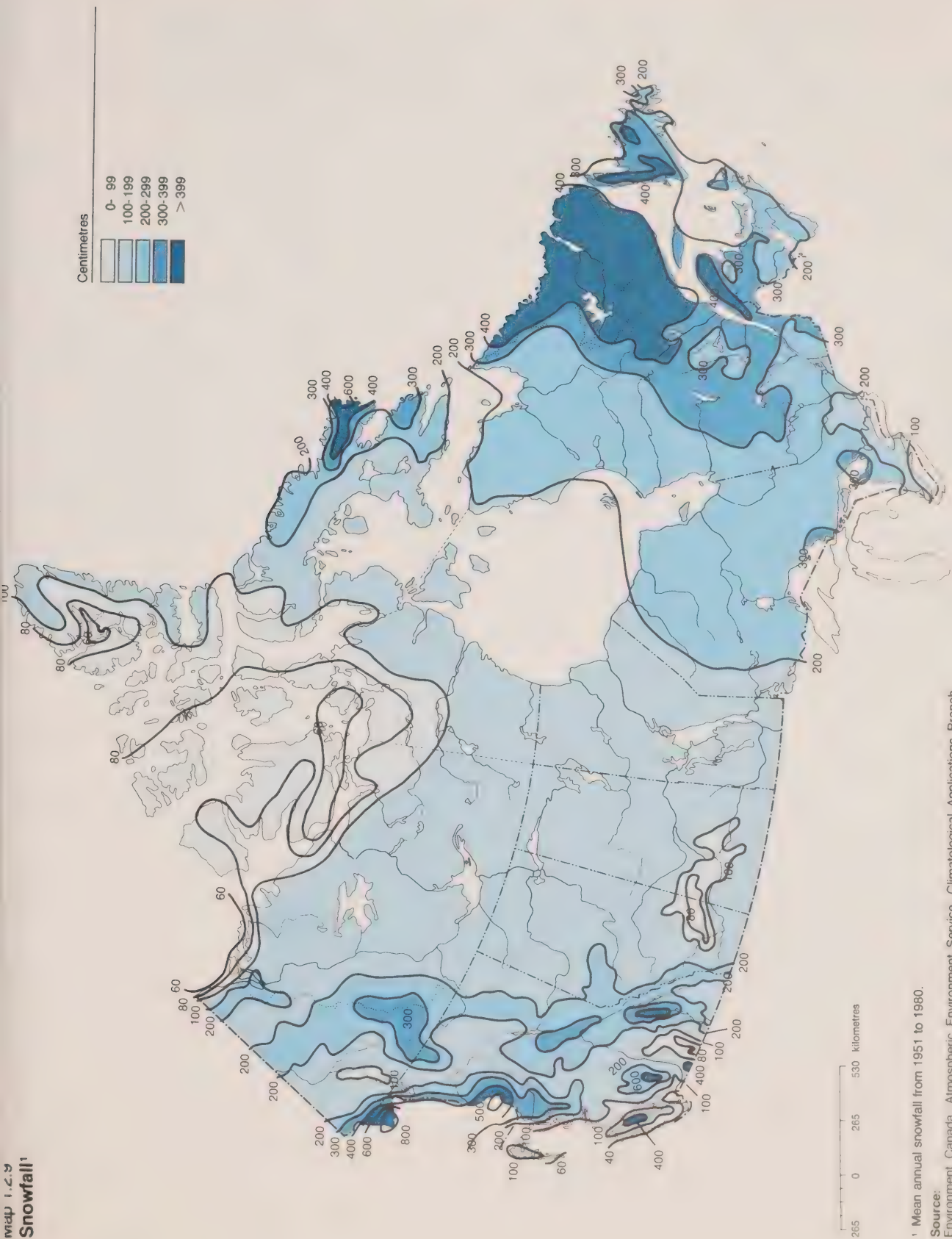




Map 1.2.8
Precipitation¹

¹ Mean annual precipitation for 1951 to 1980.

Source: Environment Canada, Atmospheric Environment Service, Climatological Applications Branch, 1984.



¹ Mean annual snowfall from 1951 to 1980.
Source: Environment Canada, Atmospheric Environment Service, Climatological Applications Branch, 1984.

Table 1.2.10
Climate Profile of Canada

Ecozone	Last Spring Frost ¹	First Fall Frost ¹	Frost-Free Period(Days) ²	Growing Degree Days above 5 Degrees (C) ¹	Days with Temperatures Below 0 Degrees (C) ³	Hours with Temperatures Greater Than + 30 Degrees (C) ⁴
	average date		annual average			
Atlantic Maritime						
Halifax	May 12	October 15	155	1 694	167	5
Saint John	May 16	October 3	139	1 499	175	2
Fredericton	May 19	September 23	126	1 770	177	33
Mixed-Wood Plain						
Québec City	May 13	September 28	137	1 690	177 ^a	17
Montréal	May 3	October 8	157	2 113	149 ^a	31
Ottawa	May 7	October 2	147	2 043	166	49
Toronto	May 8	October 5	149	2 127	154	73
Windsor	April 26	October 21	177	2 533	135	81
Boreal Shield						
St. John's	June 1	October 11	131	1 196	177 ^a	0
Sudbury	May 18	September 24	128	1 664	168	16
Thunder Bay	May 30	September 2	104	1 425	205 ^a	20
Prairie						
Winnipeg	May 23	September 22	121	1 785	195	56
Regina	May 24	September 11	109	1 677	207	91
Lethbridge	May 17	September 19	124	1 776	175 ^a	69
Edmonton	May 25	September 8	105	1 328	192	10
Calgary	May 25	September 15	112	1 387	261	17
Boreal Plain						
Peace River	May 31	September 2	93	1 239	217	7
Montane Cordillera						
Kamloops	May 4	October 1	149	2 216	146 ⁷	143
Prince George	June 6	August 31	85	1 199	203 ⁷	7
Pacific Maritime						
Victoria	April 16	November 4	201	1 864	60	6
Prince Rupert	May 11	October 15	156	1 148	71	0
Boreal Cordillera						
Whitehorse	June 8	August 30	82	897	219 ⁷	<1
Dawson	June 13	August 17	64	..	234	1
Taiga Plain						
Fort Simpson	June 3	August 21	79	1 166	226 ^a	2
Hay River	June 2	September 11	100	1 050	227 ²	4
Norman Wells	May 28	September 1	95	1 023	239 ²	2
Taiga Shield						
Goose Bay	June 5	September 18	104 ^a	1 022	214 ^a	6
Yellowknife	May 27	September 16	111	1 022	229 ⁷	1
Hudson Bay Plain						
Churchill	June 24	September 9	76	555	255	1
Southern Arctic						
Fort Chimo	June 27	September 2	66	509	253 ⁷	<1
Baker Lake	June 23	August 30	67	392	279 ⁷	0
Inuvik	June 23	August 14	51	665	269 ⁷	<1
Northern Arctic						
Profisher Bay	June 28	August 27	59	179	272 ^a	0
Resolute	July 10	July 20	9	33	321 ^a	0
Arctic Cordillera						
Alert	July 14	July 19	4	33	316 ⁷	0
Sachs Harbour	July 10	July 22	11	118	314 ⁷	0

Table 1.2.10
Climate Profile of Canada (concluded)

Ecozone	Hours with Temperatures Less Than -20 Degrees (C)*	Hours of Bright Sunshine	Precipitation (mm) ¹	Days with Snowfall ¹	Days with Snow Cover ²	Wind Speed (kms/h)
annual average						
Atlantic Maritime						
Halifax	27	1 883	1 491	64	60*	20
Saint John	92	1 819	1 444	59	82	19
Fredericton	123	1 860	1 109	56	115	14
Mixed-Wood Plain						
Québec City	233	2 018	946	62	115	16
Montréal	130	1 995	879	62	116	15
Ottawa	190	1 829*	1 174	73	139	16
Toronto	32	2 045	762	47	72	15
Windsor	8	1 980*	849	45	43	17
Boreal Shield						
St. John's	2	1 458	1 514	88	120	24
Sudbury	396	..	861	79	139	21
Thunder Bay	555	..	712	61	..	17
Prairie						
Winnipeg	884	2 230	526	57	126	19
Regina	744	2 277	384	58	130	21
Lethbridge	330	2 387	423	53	81	20
Edmonton	691	2 356	467	61	121	13
Calgary	415	2 208	424	62	99	16
Boreal Plain						
Peace River	971	..	375	59	..	13
Montane Cordillera						
Kamloops	81	2 032	257	33	63	12
Prince George	292	1 865	628	78	140	11
Pacific Maritime						
Victoria	0	2 183	873	13	8	11
Prince Rupert	9	1 036	2 523	35	25	15
Boreal Cordillera						
Whitehorse	872	1 825	261	73	165	14
Dawson	1 922	..	306	..	187	4
Taiga Plain						
Port Simpson	1 958	1 915	355	72	193	9
Hay River	1 875	..	340	75	185	12
Norman Wells	2 502	..	328	87	206	12
Taiga Shield						
Goose Bay	621	1 674	946	97	190	16
Yellowknife	2 310	..	267	82	191	16
Hudson Bay Plain						
Churchill	2 345	..	402	100	209	23
Southern Arctic						
Fort Chimo	1 600	1 863	266	99	..	10
Baker Lake	3 387	..	235	73	249	22
Inuvik	2 848	..	504	99	210	16
Northern Arctic						
Frobisher Bay	2 193	1 435	433	106	239	17
Resolute	3 933	1 459	131	82	281	22
Arctic Cordillera						
Alert	4 411	..	155	93	305	10
Sachs Harbour	3 651	1 712	114	67	..	21

¹ Based on 1951 to 1980 climate normals. A normal is the annual average determined for a specified period, usually twenty-five years.
² Based on 1959 to 1980 normals.
³ Based on 1941 to 1970 normals except as noted.
⁴ Based on a normal period of ten to twenty-nine years.
⁵ Figure for Harrow, Ontario.
⁶ Based on a normal of ten years or less.
⁷ Based on a ten year normal.

Source:
Environment Canada, Atmospheric Environment Service, *Canadian Climate Normals*, various issues.

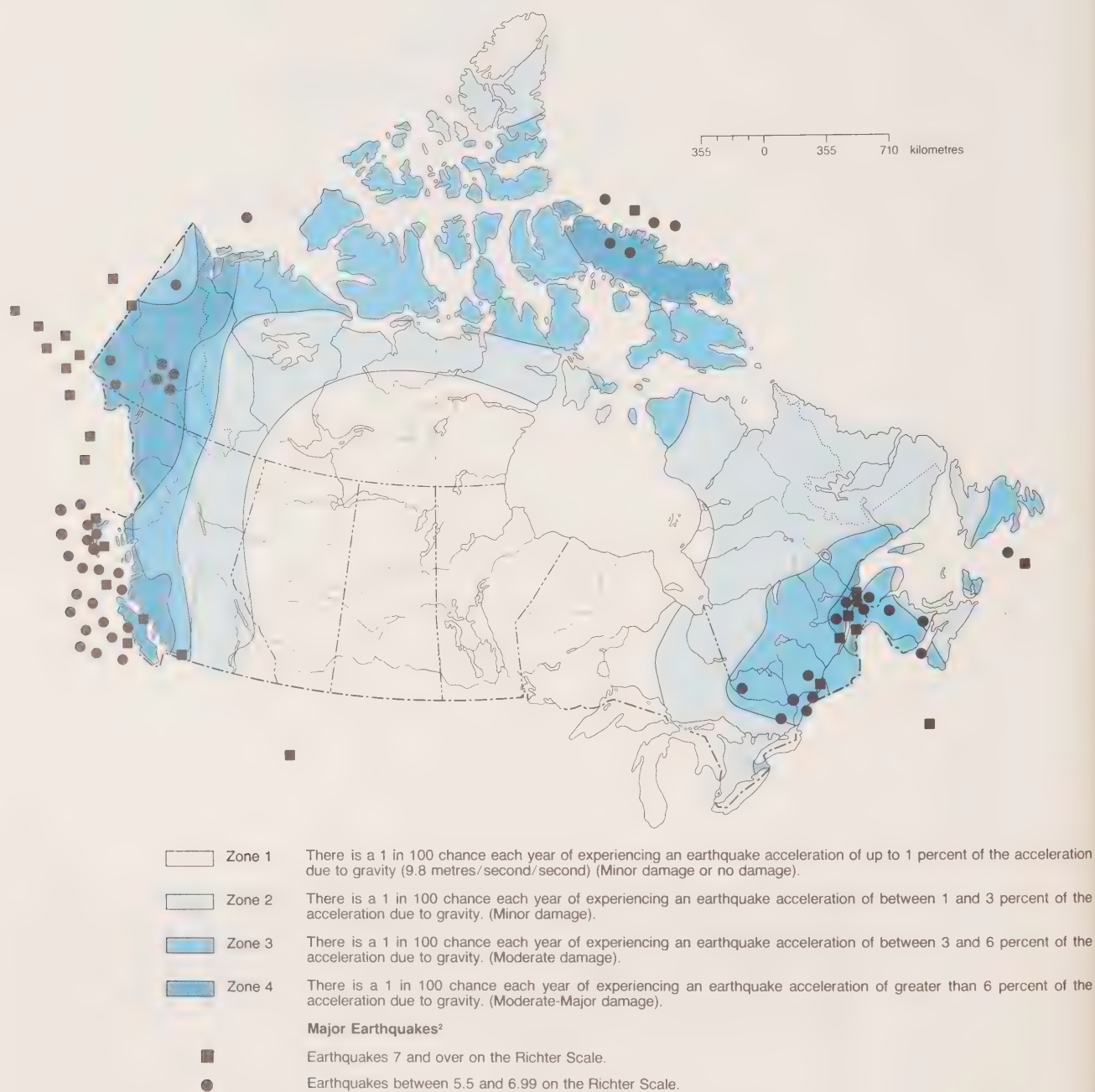
Notes:
The above climatological profile is composed of observations from major weather stations located at airports. The stations were selected in an attempt to best represent the observed climatological conditions throughout the ecozones.
Complete coverage of all ecozones was not possible because few stations exist in remote northern areas. For this reason no data are shown for the Tundra Cordillera.
Cross Reference: For a discussion of growing degree days, see Map 1.2.4.

1.3

Major Geophysical and Meteorological Events



Map 1.3.1
Earthquake Severity Potential¹



¹ This map divides Canada into 4 earthquake severity potential zones. The map was developed in response to the need for earthquake specifications in the National Building Code of Canada. These zones do not indicate the frequency of earthquakes or the risk of an earthquake taking place but rather the degree of severity of a quake should one occur. For more information refer to "The New Seismic Zoning Map for Canada 1970", Department of Energy, Mines and Resources.

² Earthquakes greater than Richter Scale 7, felt in Canada but with epicentres outside Canada are also shown.

Source:
Energy Mines and Resources Canada, Earth Science Branch, Seismology Division.

Table 1.3.2
Major Earthquakes

Year	Richter Scale ¹	Epicentre Location	Impacts
1663	7.5 - 8.0 ²	Lower St. Lawrence River	Many landslides
1732	7.0 ²	Montréal	Houses damaged in Montréal, one death
1831	5.5 - 6.0 ²	St. Lawrence River Basin (two quakes)	..
1855	5.5 - 6.0 ²	Moncton	..
1860	6.5 - 7.0 ²	Mouth of Saguenay River, Québec	..
1861	5.5 - 6.0 ²	Ottawa	Damage to chimneys
1870	7.0 ²	Mouth of the Saguenay River, Québec	Brick structures damaged extensively
1872	7.5 ²	East of Vancouver	..
1897	5.6 ²	Near Montréal	..
1914	5.6 ²	Lanark, Ontario	..
1918	7.0	Vancouver Island	..
1924	6.1	La Malbaie, Québec	..
1925	7.0	Mouth of the Saguenay River, Québec	All chimneys destroyed in epicentre area, major structural damage to buildings
1929	7.2	Grand Banks, Newfoundland	Trans Atlantic cables were severed, seismic sea wave killed twenty-seven in Newfoundland
1929	7.0	Queen Charlotte Sound, British Columbia	..
1933	7.3	Baffin Bay, Northwest Territories	..
1935	6.2	Timiskaming, Québec	Chimneys were toppled as far away as Mattawa, Ontario
1944	6.5	Cornwall, Ontario	Major structural damage to buildings
1944	6.5	Whitehorse, Yukon	..
1946	7.3	Strait of Georgia, British Columbia	Structural damage to buildings
1949	8.0	Queen Charlotte Islands, British Columbia	Minor damage
1952	6.0	South of Whitehorse, Yukon	..
1953	6.5	East Central Yukon	..
1955	6.5	East Central Yukon	..
1956	6.5	East Central Yukon	..
1956	6.8	West of Vancouver Island	..
1956	6.5	Queen Charlotte Islands	..
1957	6.8	West of Vancouver Island	..
1960	6.7	Queen Charlotte Islands	..
1970	7.0	Queen Charlotte Islands	..
1972	6.2	Near Nootka Island, British Columbia	..
1972	6.2	West of Vancouver Island	..
1979	7.1	Alaska-Yukon Border	Minor property damage
1982	5.7	North Central New Brunswick	Little damage
1985	6.6	Western Northwest Territories	Minor damage

¹ The Richter scale is a logarithmic scale used to measure the intensity of an earthquake. For example, an earthquake of Scale Five is ten times as intense as a Scale Four earthquake.

² Estimated Magnitude.

Source:
Energy Mines and Resources Canada, Earth Physics Branch, Seismology Division.

Notes:
Earthquakes documented in this table were of Richter scale magnitude 5.5 or greater. Many other earthquakes of lesser magnitude have occurred in

Canada. These may have had significant impacts but are not accounted for here.

It should also be noted that earthquakes in this table had epicentres within Canada. Other quakes with epicentres outside Canada have not been included. For example, the earthquake of October 7, 1984, magnitude 5.1, epicentre in New York State, which was felt in much of Southern Québec and Ontario, is not included here. This listing omits some of the smaller quakes which have occurred in isolated northern areas. These are, however, included on Map 1.3.1.

Table 1.3.3
Major Storms

Date	Location	Type of Storm and Characteristics	Major Impacts
August 25, 1873	Cape Breton	Hurricane	Many deaths, 1,200 boats destroyed
April 2 to 6, 1885	Ottawa Valley	Heavy snow (108 cm) followed by heavy rain (50 mm)	Communications paralyzed
January 9, 1889	Niagara Falls	Snow storms with high winds	Niagara suspension bridge blown down
June 30, 1912	Regina	Tornado	Twenty-eight killed, hundreds injured, extensive property damage
November 7 to 13, 1913	Lower Great Lakes, Ontario	Rain storm with winds of 80 to 130 km/h	Rough seas resulted in the loss of eight ships and drowning of 200 seamen
June 22, 1922	Portage la Prairie, Manitoba	Tornado	Five deaths, many injured, extensive property damage
September 17, 1932	Maritime Provinces	Tropical storm with high winds and heavy rains	Much of the Annapolis apple crop was destroyed, waves and wind damaged fishing boats and gear throughout the Maritimes
January 19, 20, 1935	Southern British Columbia	Heavy snow (44 cm) followed by low temperatures (-20 C)	Roads were impassable for days, roofs collapsed throughout the area
December 11, 12, 1944	Southern Ontario, Québec	Heavy snow (52 cm) and strong winds	Roads blocked for days by drifts
June 17, 1944	Windsor, Ontario	Tornado	Sixteen people killed, 100 injured
July 29, 1946	Okanagan Valley, British Columbia	Hailstorm with stones of 5 cm diameter	Major damage to the pear and apple crops
May 21, 1953	Sarnia, Ontario	Thunderstorm and tornadoes	Five killed, forty injured, extensive property damage
October 14, 15, 1954	Southern Ontario	"Hurricane Hazel"	Widespread wind and flood damage, eighty deaths
June 19, 1955	Vita, Manitoba	Tornado	300 persons injured
January 5, 6, 1956	New Brunswick and Prince Edward Island	Ice storm with high winds	Ice coating (10 cm) on trees, wires caused considerable damage
August 16, 1956	Elkhorn and Crystal City, Manitoba	Hailstorm and tornadoes	Crops destroyed and buildings demolished
February 27, to March 2, 1958	St. John's, Newfoundland	Freezing rain which lasted 43 hours	Heavy ice caused power disruptions in much of Province
February 16, 1959	St. John's Newfoundland	Heavy snow with strong winds	Six deaths, power disruptions, transport and communications paralyzed
February 28, 1959	Listowel, Ontario	Heavy snow followed by rain	An arena roof collapse resulted in eight deaths
June 19, 1959	Northumberland Strait, Nova Scotia	Squall	Several drownings when fishing boats capsized
February 25, 26, 1961	Montréal area	Ice storm with high winds (120 km/h)	Major damage to public utilities
August 31, 1961	Timmins, Ontario	Thunderstorm with hail	Five deaths due to floods and damage to structures and automobiles
December 1, 2, 1964	Nova Scotia, New Brunswick	Rain/snow storm with high winds gusting up to 160 km/h	Twenty-three deaths, three fishing boats capsized by waves
February 18, 1965	Stewart, British Columbia	Heavy snow	Avalanche killed twenty-six, injured twenty
March 4, 1966	Winnipeg area	Heavy snow (36 cm) and strong winds (120 km/h)	City paralyzed for two days by drifting snow
April 17 to 20, 1967	Southern Alberta	Two snow storms dropped 203 cm of snow within one week	Thousands of cattle starved
January 13 to 15, 1968	Southern Ontario	Snow and ice storm	Transport and communication disruptions, extensive damage to trees

Table 1.3.3
Major Storms (concluded)

Date	Location	Type of Storm and Characteristics	Major Impacts
August 1, 1969	Montréal area	Hail storm with stones as large as 6.9 cm diameter	Widespread damage
August 4, 1969	Edmonton area	Hail storm and tornadoes	Widespread damage
November 7 to 13, 1969	Québec	Freezing rain	Extensive damage to utilities
July 11, 1970	Alberta	Hail storm with high winds (120 km/h)	Extensive damage to structures, trees, crops
August 20, 1970	Georgian Bay to Québec border	Tornado	In the Sudbury area, four persons killed, 750 persons left homeless, thousands of trees felled
March 4, 1971	Southern Québec	Heavy snow (43 cm) with high winds (100 km/h)	Montréal paralyzed for two days
April 2 to 5, 1975	Eastern Canada	Heavy snow with high winds	Communities isolated for several days, extensive damage, including to ships
June 25, 1975	Saskatchewan	Thunderstorms with high winds	Extensive crop and property damage
February 2, 1976	Maritime Provinces	Heavy rain and snow with strong winds	Power and transportation disruptions
January 28 to 31, 1977	Niagara Peninsula and Prince Edward County, Ontario	Heavy snow and high winds	Communities paralyzed, transport disrupted
January 26, 1978	Southern Ontario	Heavy snow and high winds (115 km/h)	Twelve deaths, extensive damage
February, 1978	Regina area	Heavy snow and high winds which lasted a week	Snowdrifts paralyzed community for days
August 9, 1979	Woodstock, Ontario	Three tornadoes	Extensive damage
February 8 to 17, 1979	Frobisher Bay, Northwest Territories	Blizzard with 100 km/h wind gusts, temperatures of -40 C	Community cut off for ten days
April 14, 1980	Okanagan Valley, British Columbia	Thunderstorm with wind gusts to 139 km/h at Kelowna	Wind uprooted trees and caused power failures
May 31, 1980	Brampton, Ontario	Tornado with thunderstorms	Extensive damage
July 28, 1981	Calgary area	Hailstorms	Two deaths, extensive damage
February 14, 15, 1982	Newfoundland	Heavy snow with high winds	Ocean Ranger oil-rig sank, eighty-four deaths
February 22 to 26, 1982	Prince Edward Island, Magdalen Islands, Québec	Succession of storms with heavy snow and high winds	Communities isolated for several days, power and communication disruptions
March 6, 1983	Winnipeg	Freezing rain	Extensive damage, transport disruptions
December 13, 1983	Southern Québec	Freezing rain	Major power disruptions throughout region
April 13, 1984	Newfoundland	Freezing rain	Power and communications disruptions
July 15, 1984	Blue Sea Lake and West Québec	Tornado	One dead, thirty-eight injured
August 14, 1984	Toronto	Tornado	Extensive damage
September 2, 1984	London, Ontario	Tornado	Thirty persons injured
May 31, 1985	Barrie, Orangeville, Tottenham, Grand Valley, Alliston, Ontario	Tornado	Twelve dead, 165 injured, 450 homes destroyed

Source:
Environment Canada, Atmospheric Environment Service, Downsview, Ontario.

Notes:
The criterion for inclusion of storms here is major impact on man. In a number of cases significant storms have not been listed because they caused only minor damage or occurred in isolated locations.
In addition, the listing of storms is weighted somewhat to present more information from recent years. It should be noted that this is partly a function of the change in quality of the reporting system through time.

Table 1.3.4
Major Floods

Year	Location	Cause	Major Impacts
1826, Spring	Red River, Manitoba	Spring run-off	Widespread damage, river fourteen feet above normal
1878, Summer	Don River, Toronto, Ontario	Heavy rain, thirteen cms in 7.5 hours	Widespread damage to residence and utilities
1894, Summer	Fraser and Columbia River Basins	Spring run-off	Widespread damage
1913, Spring	Amherst and Cumberland County, Nova Scotia	Heavy rain	Widespread damage, two deaths
1915, Summer	North Saskatchewan River, Edmonton, Alberta	Heavy rain	Widespread damage
1917, Summer	Chaudière River, Québec	Rain	Widespread damage
1928, Spring	Estrie River, Québec	Spring run-off	Widespread damage, four deaths
1929, Fall	Burin Péninsula, Newfoundland	Seismic sea-wave	Twenty-nine deaths
1936, Spring	New Brunswick	Spring run-off	Many bridges, dams washed out
1948, Spring	Lower Fraser River, British Columbia	Spring run-off and heavy rain	200 square kilometres flooded, 2,000 homes damaged, disaster relief - \$38.6 million
1950, Spring	Red River, Manitoba	Spring run-off and heavy rain	1,760 square kilometres of land flooded, 100,000 people evacuated, extensive damage to homes in Winnipeg, disaster relief - \$46.7 million
1954, Fall	Humber River, Toronto, Ontario	Heavy rain from Hurricane Hazel	Eighty drowned, disaster relief - \$43.1 million
1955, Spring	Saskatchewan	Spring run-off and heavy rain	Disaster relief - \$16.5 million
1955, Spring	Manitoba	Spring run-off and heavy rain	Disaster relief - \$4.6 million
1957, Summer	Bécancour, Québec	Heavy rain	Widespread damage, four deaths
1961, Summer	Timmins, Ontario	Heavy rain	Widespread damage, five deaths
1964, Spring	Port Alberni, British Columbia	Seismic sea-wave from Alaska earthquake	Much damage in coastal areas, disaster relief - \$2.0 million
1964, Spring	Old Man and Milk River Basins, Alberta	Heavy rain	Twenty-one persons died in the portions of the Basins in Montana
1966, Spring	Red River, Manitoba	Spring run-off and heavy rain	Disaster relief - \$14.8 million
1966, Fall	North Shore, Québec	Heavy rain	Widespread damage, four deaths
1970, Spring	New Brunswick	Spring run-off and heavy rain	Widespread damage, two deaths, disaster relief - \$4.2 million
1971, Summer	Nova Scotia, around Halifax	Heavy rain from Hurricane Beth	Disaster relief - \$2.5
1972, Spring	Fraser River, British Columbia	Spring run-off and heavy rain	Disaster relief - \$4.8
1972, Summer	Peace River, Smokey River, Alberta	Heavy rain	Extensive damage in Grande Prairie, agricultural losses, disaster relief - \$8.7 million
1972, Fall	Western end of Lake Erie	Wind driven waves	Extensive damage
1973, Spring	New Brunswick	Spring run-off and heavy rain	Widespread damage, disaster relief - \$7.1 million
1974, Spring	Grand River, Cambridge, Ontario	Heavy rain	Extensive damage
1974, Spring	Southern Québec	Spring run-off	Disaster relief - \$16.7 million
1974, Spring	Saskatchewan	Spring run-off	Disaster relief - \$5.1 million
1974, Spring	Alberta	Spring run-off	Disaster relief - \$6.5 million
1976, Spring	Red River, Manitoba	Spring run-off	Disaster relief - \$3.1 million
1976, Spring	Nova Scotia	Heavy rain	Disaster relief - \$2.6 million
1976, Spring	Québec	Spring run-off, heavy rain, ice jams	Disaster relief - \$12.9 million
1978, Spring	Northwest British Columbia	Spring run-off	Disaster relief - \$4.5 million
1979, Spring	Manitoba	Spring run-off	Disaster relief - \$8.8 million
1979, Spring	Sturgeon River, Field, Ontario	Heavy rain and spring run-off	Major damage in Field

Table 1.3.4
Major Floods (concluded)

Year	Location	Cause	Major Impacts
1979, Spring	Dawson, Yukon	Ice jams and spring run-off	Extensive damage, disaster relief - \$1.0 million
1979, Spring	New Brunswick	Spring run-off and heavy rain	Disaster relief - \$1.6 million
1980, Spring	Ganaraska River, Port Hope, Ontario	Spring run-off and heavy rain	Major damage to Port Hope
1980, Winter	Southwestern British Columbia	Heavy rain	Widespread damage
1981, Fall	South coast, British Columbia	Heavy rain	Landslides, disaster relief - \$2.0 million
1981, Fall	Turkey Creek, Windsor, Ontario	Heavy rain during thunderstorm	Damage to southeastern section of city
1982, Spring	Aklavik, Northwest Territories	Spring run-off and ice jams	Extensive damage
1983, Winter	Newfoundland	Heavy rain	Dam burst on the Exploits River, damage to Grand Falls and Bishops Falls
1983, Spring	Regina, Saskatchewan	Spring run-off	Extensive damage

Sources:

Environment Canada, Inland Waters Directorate, Water Planning and Management Branch.

Environment Canada, Atmospheric Environment Service.

Emergency Planning Canada.

Notes:

The criterion for inclusion of floods here is major impact on man. In a number of cases significant floods have not been listed because they caused only minor damage or occurred in isolated locations. In addition, the listing of floods is weighted somewhat to present more information for recent years. It should be noted that this is partly a function of the change in quality of the reporting system through time.

Disaster relief payments are made by the Federal and Provincial Governments under the "Disaster Relief Assistance Programme" of Emergency Planning Canada. Actual damages in dollars always exceed disaster relief as many losses are not included under the agreement. These figures are in constant 1971 dollars. Current values were converted using the Gross National Expenditure Implicit Price Index (1971 = 100).

2

Population



Contents

Tables

2.1.3	Population and Population Density by Ecozone, 1971, 1976 and 1981	44
2.1.4	Population and Population Density by Major Drainage Area, 1971, 1976 and 1981	46
2.1.7	Population of American Drainage Basins with Waters Flowing into Canada, 1980	49
2.1.8	Population of Major Urban Areas by Ecozone, 1981	50
2.1.9	Rural-Urban Population by Major Drainage Area, 1971, 1976 and 1981	51
2.1.10	Population of Major Urban Areas by Major Drainage Area, 1981	52
2.1.11	Experienced Labour Force by Major Drainage Area, 1971 and 1981	54
2.1.12	Ecozone Socio-Economic Profile, 1971 and 1981	56

Maps

2.1.1	Population and Population Density by Ecozone, 1981	43
2.1.5	Population by Drainage Basin, 1981	47
2.1.6	Population Density by Drainage Basin, 1981	48

Chart

2.1.2	Population by Ecozone, 1981	44
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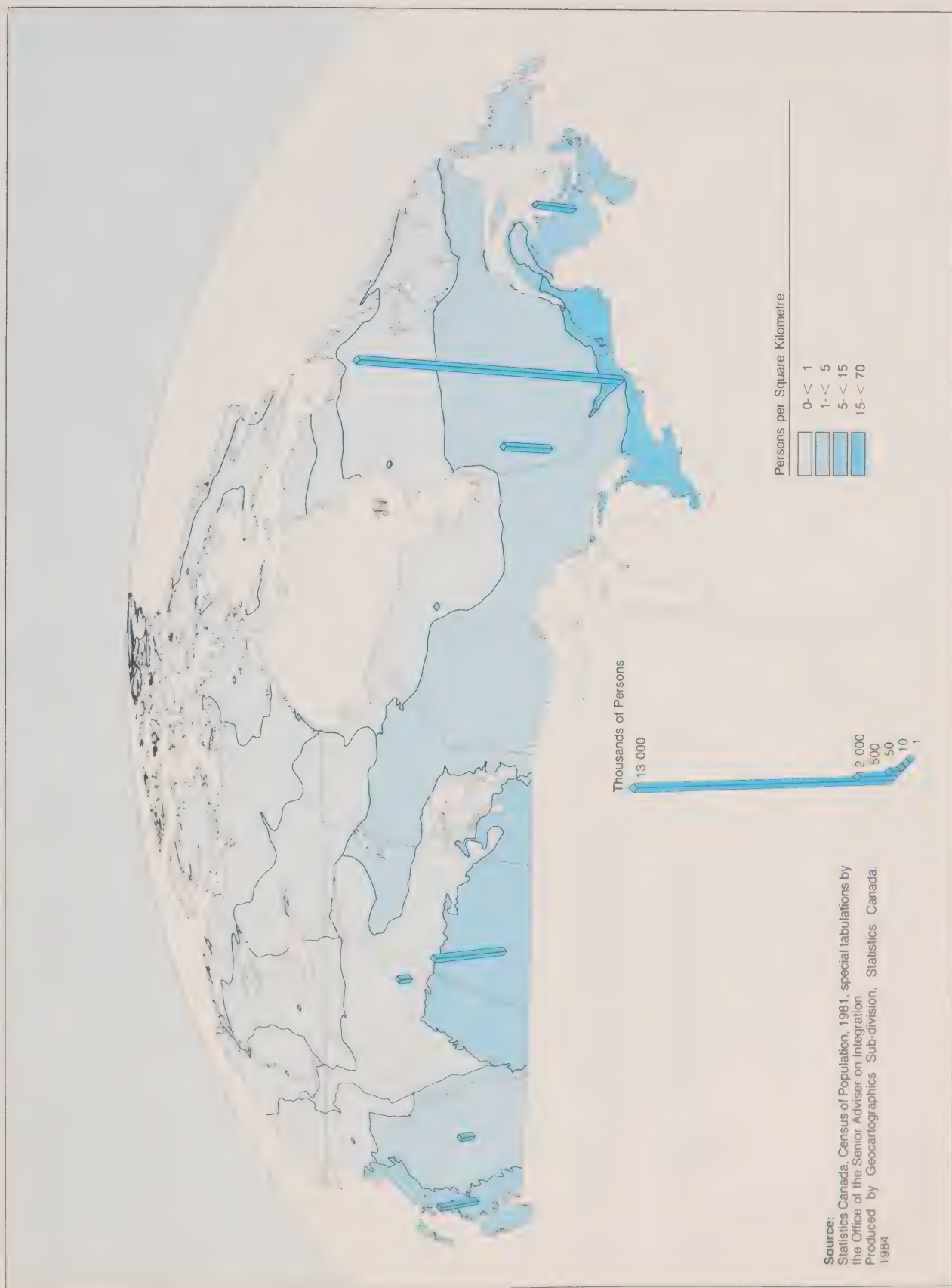
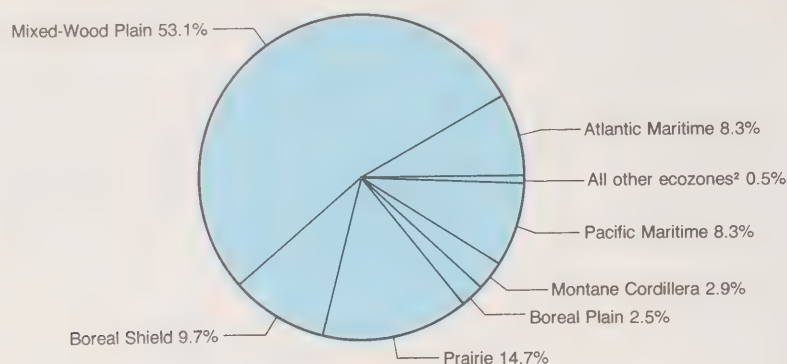


Chart 2.1.2
Population¹ by Ecozone, 1981



¹ Population of Canada was 24 343 181 in 1981.

² Includes Boreal Cordillera, Tundra Cordillera, Taiga Plain, Taiga Shield, Hudson Bay Plain, Southern Arctic, Northern Arctic and Arctic Cordillera.

Source:

Statistics Canada, Census of Population, 1981.

Table 2.1.3
Population and Population Density by Ecozone, 1971, 1976 and 1981

Ecozone	Area	Total Population			Population Density ²			Percentage Change in Population ³	
		1971 ¹	1976	1981	1971	1976	1981	1971-1976	1976-1981
	square kilometres				persons/square kilometre				
Atlantic Maritime	188 810	1 880 300	1 966 983	2 018 573	10	10	11	4.6	2.6
Prince Edward Island	5 660	111 640	118 229	122 506	20	21	22	5.9	3.6
Nova Scotia	55 490	788 960	828 571	847 442	14	15	15	5.0	2.3
New Brunswick	72 950	634 170	676 863	696 012	9	9	10	6.7	2.8
Québec	54 710	345 530	343 320	352 613	6	6	6	-0.6	2.7
Mixed-Wood Plain	194 955	11 723 495	12 438 504	12 937 746	60	64	66	6.1	4.0
Québec	56 935	4 903 165	5 074 561	5 218 574	86	89	92	3.5	2.8
Ontario	138 020	6 820 330	7 363 943	7 719 172	49	53	56	8.0	4.8
Boreal Shield	1 817 845	2 206 615	2 292 040	2 352 274	1	1	1	3.9	2.6
Newfoundland	122 985	495 915	526 987	538 822	4	4	4	6.3	2.2
New Brunswick	490	390	387	391	1	1	1	...	...
Québec	693 705	767 985	800 702	847 899	1	1	1	4.3	5.9
Ontario	652 180	877 085	895 532	900 487	1	1	1	2.1	0.6
Manitoba	248 455	57 340	59 600	53 156	<1	<1	<1	3.9	-10.8
Saskatchewan	100 030	7 895	8 832	11 519	<1	<1	<1	11.9	30.4
Prairie	491 135	2 982 080	3 190 644	3 578 205	6	6	7	7.0	12.1
Manitoba	70 515	833 000	865 591	875 574	12	12	12	3.9	1.2
Saskatchewan	253 645	782 885	774 904	817 916	3	3	3	-1.0	5.6
Alberta	166 975	1 366 195	1 550 149	1 884 715	8	9	11	13.5	21.6
Boreal Plain	882 595	511 315	535 803	611 518	1	1	1	4.8	14.1
Manitoba	129 685	94 280	93 000	94 388	1	1	1	-1.4	1.5
Saskatchewan	258 765	132 910	135 294	136 128	1	1	1	1.8	0.6
Alberta	375 850	241 125	264 169	326 917	1	1	1	9.6	23.8
British Columbia	93 895	41 875	41 946	52 862	<1	<1	1	0.2	26.0
Yukon	23 975	1 120	1 394	1 223	<1	<1	<1	24.5	-12.3
Northwest Territories	425	0	0	0	0	0	0	...	...
Montane Cordillera	463 300	506 310	618 067	697 675	1	1	2	22.1	12.9
Alberta	43 855	20 170	23 287	25 333	<1	1	1	15.5	8.8
British Columbia	419 445	486 135	594 780	672 342	1	1	2	22.3	13.0

Table 2.1.3
Population and Population Density by Ecozone, 1971, 1976 and 1981 (concluded)

Ecozone	Area	Total Population			Population Density ²			Percentage Change in Population ³	
		1971 ¹	1976	1981	1971	1976	1981	1971-1976	1976-1981
	square kilometres				persons/square kilometre				
Pacific Maritime	197 040	1 652 500	1 825 014	2 014 099	8	9	10	10.4	10.4
British Columbia	197 040	1 652 500	1 825 014	2 014 099	8	9	10	10.4	10.4
Boreal Cordillera	425 770	19 370	24 032	25 838	<1	<1	<1	24.1	7.5
British Columbia	207 535	3 390	4 356	4 668	<1	<1	<1	28.5	7.2
Yukon	218 235	15 985	19 676	21 170	<1	<1	<1	23.1	7.6
Tundra Cordillera	376 960	1 525	1 082	1 164	<1	<1	<1	-29.0	7.6
Yukon	227 745	1 285	762	759	<1	<1	<1	-40.7	-0.4
Northwest Territories	149 215	240	320	405	<1	<1	<1	...	...
Taiga Plain	557 240	13 255	15 706	15 446	<1	<1	<1	18.5	-1.7
Alberta	68 090	385	432	759	<1	<1	<1	...	...
British Columbia	29 885	715	512	496	<1	<1	<1	-28.4	...
Yukon	5 485	0	0	0	0	0	0	...	...
Northwest Territories	453 780	12 155	14 762	14 191	<1	<1	<1	21.4	-3.9
Taiga Shield	1 301 290	41 780	52 328	55 344	<1	<1	<1	25.2	5.8
Newfoundland	226 515	24 500	28 720	26 686	<1	<1	<1	17.2	-7.1
Québec	490 095	7 940	12 551	14 668	<1	<1	<1	58.1	16.9
Manitoba	122 630	345	47	952	<1	<1	<1	...	...
Saskatchewan	39 890	2 545	2 293	2 750	<1	<1	<1	-9.9	19.9
Alberta	6 420	0	0	0	0	0	0	...	...
Northwest Territories	415 740	6 450	8 717	10 288	<1	<1	<1	35.1	18.0
Hudson Bay Plain	370 820	10 645	10 177	9 976	<1	<1	<1	-4.4	-2.0
Québec	8 625	1 080	1 071	1 335	<1	<1	<1	-0.8	24.6
Ontario	278 380	5 690	4 990	5 448	<1	<1	<1	-12.3	9.2
Manitoba	78 665	3 275	3 268	2 171	<1	<1	<1	-0.2	-33.6
Northwest Territories	5 150	595	848	1 022	<1	<1	<1	42.5	20.5
Southern Arctic	992 595	10 410	12 096	14 360	<1	<1	<1	16.2	18.7
Newfoundland	56 220	1 690	2 018	2 173	<1	<1	<1	19.4	7.7
Québec	157 360	530	652	2 008	<1	<1	<1	23.0	208.0
Yukon	8 010	0	4	1	0	<1	<1	...	...
Northwest Territories	771 005	8 195	9 422	10 178	<1	<1	<1	15.0	8.0
Northern Arctic	1 408 590	7 990	9 193	10 036	<1	<1	<1	15.1	9.2
Québec	79 250	1 535	1 588	1 306	<1	<1	<1	3.5	-17.8
Northwest Territories	1 329 340	6 455	7 605	8 730	<1	<1	<1	17.8	14.8
Arctic Cordillera	301 665	720	935	927	<1	<1	<1	29.9	-0.9
Canada	9 970 610	21 568 310	22 992 604	24 343 181	2	2	2	6.6	5.9

The 1971 Census figures have been random rounded. Since they have been rounded independently, individual items may not add exactly to totals. <1 indicates that the population density is less than 1 when rounded to the nearest whole number.

... is used in cases of areas where at least one of the population figures involved in the calculation of the percentage change is less than 500 persons.

Source:

Statistics Canada, Census of Population 1971, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

Table 2.1.4
Population and Population Density by Major Drainage Area, 1971, 1976 and 1981

Major Drainage Area ¹	Area	Population			Population Density ²			Percentage Change in Population	
		1971 ³	1976	1981	1971	1976	1981	1971-1976	1976-1981
	square kilometres				persons/square kilometre				
Atlantic Ocean Basin	1 559 950	15 488 130	16 371 946	16 981 283	10	10	11	5.7	3.7
Atlantic Ocean Coastal	340 260	722 905	766 613	790 481	2	2	2	6.0	3.1
Gulf of St. Lawrence Coastal	463 960	1 087 955	1 132 881	1 151 462	2	2	2	4.1	1.6
Bay of Fundy Coastal and Saint John River	62 590	653 985	696 676	712 348	10	11	11	6.5	2.2
St. Lawrence River	210 590	5 280 705	5 447 744	5 623 988	25	26	27	3.2	3.2
Ottawa River	146 685	1 172 210	1 255 402	1 298 464	8	9	9	7.1	3.4
Lake Ontario Shore	39 745	3 984 305	4 304 304	4 551 875	100	108	115	8.0	5.8
Lake Erie and Lake St. Clair Shore	37 055	1 481 910	1 577 582	1 621 106	40	43	44	6.5	2.8
Lake Huron Shore	128 520	933 185	1 012 875	1 051 119	7	8	8	8.5	3.8
Lake Superior Shore	130 545	170 970	177 869	180 440	1	1	1	4.0	1.4
Hudson Bay and Ungava Bay Basin	3 524 355	3 664 450	3 891 185	4 301 130	1	1	1	6.2	10.5
Hudson Bay and Ungava Bay Coastal	2 526 070	297 065	308 263	323 227	<1	<1	<1	3.8	4.9
Nelson River	90 365	30 255	30 897	26 276	<1	<1	<1	2.1	15.0
Lake Winnipeg Shore	336 975	775 540	798 679	812 547	2	2	2	3.0	1.7
Assiniboine River	161 845	695 370	698 517	705 202	4	4	4	0.5	1.0
Saskatchewan River	409 100	1 866 220	2 054 829	2 433 878	5	5	6	10.1	18.4
Arctic Ocean Basin	3 849 890	247 775	281 815	344 983	<1	<1	<1	13.7	22.4
Mackenzie River	1 795 365	238 305	270 820	332 747	<1	<1	<1	13.6	22.9
Arctic Ocean Coastal	2 054 525	9 470	10 995	12 326	<1	<1	<1	16.1	12.1
Pacific Ocean Basin	1 010 280	2 153 275	2 434 814	2 702 600	2	2	3	13.1	11.0
Columbia River	103 935	252 380	304 203	342 115	2	3	3	20.5	12.5
Fraser River	235 135	1 154 130	1 306 512	1 465 271	5	6	6	13.2	12.2
Yukon River	334 805	17 200	20 728	21 941	<1	<1	<1	20.5	5.9
Pacific Ocean, North Coastal	258 120	75 735	80 080	87 731	<1	<1	<1	5.7	9.6
Pacific Ocean, South Coastal	78 285	653 830	723 291	785 542	8	9	10	10.6	8.6
Gulf of Mexico Basin	26 135	14 660	12 844	13 095	1	<1	1	-12.4	2.0
Missouri River	26 135	14 660	12 844	13 095	1	<1	1	-12.4	2.0
Canada	9 970 610	21 568 310	22 992 604	24 343 181	2	2	2	6.6	5.9

¹ Refer to the Appendix for detailed data by drainage basin and provincial components.

² <1 indicates that the population density is less than 1 when rounded to the nearest whole number.

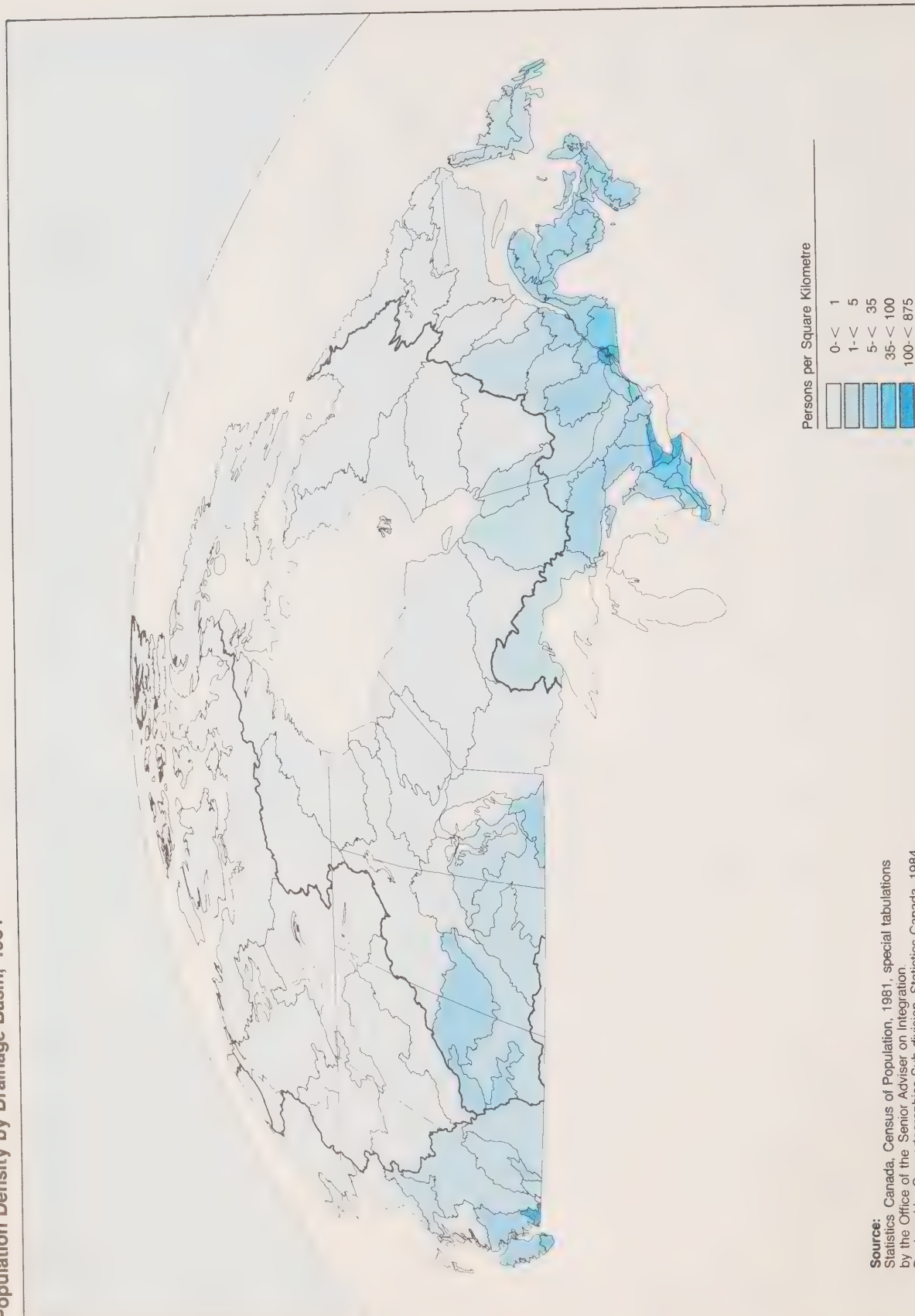
³ The 1971 Census figures have been random rounded. Since drainage area totals have been rounded independently, they may not add exactly to the Canada total.

Source:
Statistics Canada, Census of Population 1971, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

map 2.1.3
Population by Drainage Basin, 1981



Map 2.1.6
Population Density by Drainage Basin, 1981



Source: Statistics Canada, Census of Population, 1981, special tabulations by the Office of the Senior Adviser on Integration. Produced by Geocartographics Sub-division, Statistics Canada, 1984.

Table 2.1.7
Population of American Drainage Basins with Waters Flowing into Canada, 1980

Drainage Basin	Population	Area square kilometres	Corresponding Canadian Drainage Basin Reference Codes
St. Croix River¹ Maine	11 410 11 410	3 805	121
Saint John River Maine	114 629 114 629	19 060	130
Lake Memphremagog - St. Francis River and Lake Champlain - Richelieu River Vermont New York	552 474 350 415 202 059	22 800	144
Great Lakes - St. Lawrence River New York Pennsylvania Ohio Michigan Indiana Illinois Wisconsin Minnesota	25 752 440 3 698 318 256 321 4 202 704 9 262 078 2 114 974 3 668 851 2 298 417 255 777	504 455²	147, 160-165 170-173, 180-182, 190
Souris River - Rainy River - Red River - Lake Winnipeg Minnesota South Dakota North Dakota	682 492 278 419 5 308 398 765	141 720	230, 231, 240
St. Mary River - Belly River Montana	2 100 2 100	1 505	253
Milk River Montana	2 650 2 650	3 110	500
Kootenay River Montana Idaho	25 041 17 752 7 289	51 800	400
Kettle River Washington	1 214 1 214	1 478	400
Similkameen River Washington	102 102	704	402
Vedder River Washington	.. ..	763	412
Yukon River Alaska	37 37	23 300	420.1
Porcupine River Alaska	0 0	1 810	420.2
Firth River Alaska	0 0	2 870	330.1
Total, U.S.A. Basin Systems with Flow into Canada	27 144 589	779 180	

Note:
 Population figures are estimates based on 1980 Census of Population county subdivision data.

¹ St. Croix River does not flow from the U.S.A into Canada, rather it marks the international border.

² Includes surface area of Great Lakes in the U.S.A. This area is 156,960 sq. kms.

Sources:

U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Washington.

Environment Canada, *Hydrological Atlas of Canada*, 1978.

U.S. Water Resources Council, *The Nation's Water Resources, 1975-2000*.

U.S.G.P.O., Washington, 1978.

Table 2.1.8
Population of Major Urban Areas¹ by Ecozone, 1981

Ecozone	Major Urban Area	Urban Area Population	Urban Area Population as a Percentage of Ecozone Population	Rural Fringe ² Population	Rural Fringe Population as a Percentage of Ecozone Rural Population
Atlantic Maritime	Major Urban Areas (50 000 +)	656 178	32.5	132 508	13.2
	Halifax, N.S. (CMA)	277 727	13.8	50 935	5.1
	Saint John, N.B. (CMA)	114 048	5.6	19 897	2.0
	Moncton, N.B. (CA)	98 354	4.9	19 772	2.0
	Sydney, N.S. (CA)	87 489	4.3	13 100	1.3
	Fredericton, N.B. (CA)	64 439	3.2	21 836	2.2
	Québec, Qué. (CMA) (part)	14 121	0.7	6 968	0.7
Mixed-Wood Plain	Major Urban Areas (50 000 +)	9 867 019	76.3	552 566	26.1
	Toronto, Ont. (CMA)	2 998 947	23.2	99 833	4.7
	Montréal, Qué. (CMA)	2 828 349	21.9	72 539	3.4
	Ottawa-Hull, Ont./Qué. (CMA) (part)	693 045	5.4	58 781	2.8
	Québec, Qué. (CMA) (part)	556 499	4.3	37 865	1.8
	Hamilton, Ont. (CMA)	542 095	4.2	41 674	2.0
	St. Catharines-Niagara, Ont. (CMA)	304 353	2.4	23 569	1.1
	Kitchener, Ont. (CMA)	287 801	2.2	13 035	0.6
	London, Ont. (CMA)	283 668	2.2	23 225	1.1
	Windsor, Ont. (CMA)	246 110	1.9	24 699	1.2
	Oshawa, Ont. (CMA)	154 217	1.2	7 637	0.4
	Sherbrooke, Qué. (CA)	117 324	0.9	17 257	0.8
	Kingston, Ont. (CA)	114 982	0.9	30 933	1.5
	Trois-Rivières, Qué. (CMA)	111 453	0.9	8 220	0.4
	Brantford, Ont. (CA)	88 330	0.7	6 530	0.3
	Peterborough, Ont. (CA)	85 701	0.7	20 054	0.9
	Sarnia, Ont. (CA)	83 951	0.6	8 728	0.4
	Guelph, Ont. (CA)	78 456	0.6	7 249	0.3
	Shawinigan, Qué. (CA) (part)	61 673	0.5	9 474	0.4
	Barrie, Ont. (CA)	61 271	0.5	10 837	0.5
	Saint-Jean-sur-Richelieu, Qué. (CA)	60 710	0.5	9 969	0.5
	Drummondville, Qué. (CA)	54 679	0.4	14 424	0.7
	Cornwall, Ont. (CA)	53 405	0.4	6 034	0.3
Boreal Shield	Major Urban Areas (50 000 +)	736 807	31.3	113 872	12.0
	St. John's, Nfld. (CMA)	154 820	6.6	23 126	2.4
	Sudbury, Ont. (CMA)	149 923	6.4	14 977	1.6
	Chicoutimi-Jonquière, Qué. (CMA)	135 172	5.7	23 358	2.5
	Thunder Bay, Ont. (CMA)	121 379	5.2	12 014	1.3
	Sault Ste. Marie, Ont. (CA)	86 962	3.7	12 450	1.3
	North Bay, Ont. (CA)	57 137	2.4	5 897	0.6
	Ottawa-Hull, Ont./Qué. (CMA) (part)	24 933	1.1	15 569	1.6
	Québec, Qué. (CMA) (part)	5 455	0.2	5 455	0.6
	Shawinigan, Qué. (CA) (part)	1 026	--	1 026	0.1
Prairie	Major Urban Areas (50 000 +)	2 151 343	60.1	61 637	7.4
	Edmonton, Alta. (CMA) (part)	656 843	18.4	40 371	4.9
	Calgary, Alta. (CMA)	592 743	16.6	0	0
	Winnipeg, Man. (CMA) (part)	583 234	16.3	19 566	2.4
	Regina, Sask. (CMA)	164 313	4.6	1 700	0.2
	Saskatoon, Sask. (CMA)	154 210	4.3	0	0
Boreal Plain	Major Urban Areas (50 000 +)	1 822	0.3	1 822	0.5
	Winnipeg, Man. (CMA) (part)	1 608	0.3	1 608	0.4
	Edmonton, Alta. (CMA) (part)	214	--	214	0.1
Montane Cordillera	Major Urban Areas (50 000 +)	210 024	30.1	39 776	13.7
	Kelowna, B.C. (CA)	77 468	11.1	21 111	7.3
	Prince George, B.C. (CA)	67 559	9.7	8 404	2.9
	Kamloops, B.C. (CA)	64 997	9.3	10 261	3.5
Pacific Maritime	Major Urban Areas (50 000 +)	1 559 358	77.4	95 573	32.5
	Vancouver, B.C. (CMA)	1 268 183	63.0	71 550	24.4
	Victoria, B.C. (CMA)	233 481	11.6	13 663	4.7
	Nanaimo, B.C. (CA)	57 694	2.9	10 360	3.5
Canada	Major Urban Areas (50 000 +)	15 182 551	62.4	997 754	16.9

¹ The major urban areas include all Census Metropolitan Areas as well as all Census Agglomerations of 50,000 population or more in 1981. For a detailed explanation of 1981 Census Metropolitan Areas and Census Agglomerations, refer to the 1981 Census Dictionary, Catalogue 99-901, May 1982. Also note: several of these urban areas are split and appear in more than one ecozone.

² The rural fringe population is the population living in the rural parts of the CA or CMA. The rural population refers to persons living outside population concentrations of 1,000 or more with a population density of 400 or more per square kilometre.

Source:

Statistics Canada, 1981 Census of Population, special tabulations by the Office of the Senior Adviser on Integration.

Table 2.1.9
Rural-Urban Population by Major Drainage Area, 1971, 1976 and 1981

Major Drainage Area ¹	Rural Population			Urban Population ²			Urban Population as a Percentage of Total Population	
	1971 ³	1976	1981	1971	1976	1981	1971	1981
Atlantic Ocean Basin	3 319 980	3 730 092	3 925 535	11 676 720	12 641 854	13 055 748	75.4	76.9
Atlantic Ocean Coastal	270 125	275 717	280 609	452 780	490 896	509 872	62.6	64.5
Gulf of St. Lawrence Coastal	544 325	592 629	625 372	543 630	540 252	526 090	50.0	45.7
Bay of Fundy Coastal and Saint John River	296 590	335 221	353 918	357 405	361 455	358 430	54.6	50.3
St. Lawrence River	835 995	945 095	1 055 338	4 444 695	4 502 649	4 568 650	84.2	81.2
Ottawa River	320 185	354 206	388 026	852 025	901 196	910 438	72.7	70.1
Lake Ontario Shore	288 755	406 033	413 172	3 204 135	3 898 271	4 138 703	91.7	90.9
Lake Erie and Lake St. Clair Shore	396 730	404 244	393 170	1 085 180	1 173 338	1 227 936	73.2	75.7
Lake Huron Shore	343 320	383 154	380 568	589 865	629 721	670 551	63.2	63.8
Lake Superior Shore	23 955	33 793	35 362	147 005	144 076	145 078	86.0	80.4
Hudson Bay and Ungava Bay Basin	1 176 780	1 188 955	1 227 124	2 489 470	2 702 203	3 074 006	67.9	71.5
Hudson Bay and Ungava Bay Coastal	130 755	141 663	158 093	168 105	166 600	165 134	56.2	51.1
Nelson River	10 240	12 013	10 149	20 020	18 884	16 127	66.2	61.4
Lake Winnipeg Shore	253 725	257 345	253 681	521 810	541 334	558 866	67.3	68.8
Assiniboine River	270 340	249 564	238 798	425 035	448 953	466 404	61.1	66.1
Saskatchewan River	511 720	528 370	566 403	1 354 500	1 526 459	1 867 475	72.6	76.7
Arctic Ocean Basin	130 230	139 278	155 788	117 540	142 537	189 285	47.4	54.9
Mackenzie River	122 810	130 603	145 795	115 490	140 217	186 952	48.5	56.2
Arctic Ocean Coastal	7 420	8 675	9 993	2 050	2 320	2 333	21.6	18.9
Pacific Ocean Basin	515 405	554 466	585 712	1 637 870	1 880 348	2 116 888	76.1	78.3
Columbia River	101 540	122 930	135 025	150 835	181 273	207 090	59.8	60.5
Fraser River	236 770	236 662	246 628	917 355	1 069 850	1 218 643	79.5	83.2
Yukon River	5 985	7 417	7 127	11 215	13 311	14 814	65.2	67.5
Pacific Ocean, North Coastal	29 580	34 541	40 008	46 160	45 539	47 723	60.9	54.4
Pacific Ocean, South Coastal	141 530	152 916	156 924	512 305	570 375	628 618	78.4	80.0
Gulf of Mexico Basin	14 660	12 844	13 095	0	0	0	0	0
Missouri River	14 660	12 844	13 095	0	0	0	0	0
Canada	5 157 075	5 625 635	5 907 254	16 411 235	17 366 969	18 435 927	76.1	75.7

¹ Refer to the Appendix for detailed data by Drainage Basin and provincial components.

² In 1971, all incorporated cities, towns and villages of 1,000 persons or more were defined as urban. Also, all population concentrations of 1,000 or more with a population density of at least 386 persons per square kilometre were classified as urban. In 1976 and 1981, all population concentrations of 1,000 or more with a population density of at least 386 (400 in the 1981 Census) persons per square kilometre were classified as urban, regardless of the legal status of the municipality.

³ The 1971 Census figures have been random rounded. Since they have been rounded independently, individual items may not add exactly to totals.

Source:
Statistics Canada, Census of Population, 1971, 1976 and 1981, special tabulations by the Office of the Senior Adviser of Integration.

Table 2.1.10
Population of Major Urban Areas¹ by Major Drainage Area, 1981

Major Drainage Area	Major Urban Area	Urban Area Population	Urban Area Population as a Percentage of Drainage Area Population	Rural Fringe ² Population	Rural Fringe Population as a Percentage of Drainage Area Rural Population
Atlantic Ocean Basin	Major Urban Areas (50 000 +)	11 260 004	66.3	798 946	20.4
Atlantic Ocean Coastal	Major Urban Areas (50 000 +)	415 758	52.6	60 717	21.6
	Halifax, N.S. (CMA) (part)	260 938	33.0	37 591	13.4
	St. John's, Nfld. (CMA)	154 820	19.6	23 126	8.2
Gulf of St. Lawrence Coastal	Major Urban Areas (50 000 +)	88 433	7.7	14 044	2.2
	Sydney, N.S. (CA)	87 489	7.6	13 100	2.1
	Moncton, N.B. (CA) (part)	841	0.1	841	0.1
	Fredericton, N.B. (CA) (part)	103	--	103	--
Bay of Fundy Coastal and Saint John River	Major Urban Areas (50 000 +)	292 686	41.1	73 905	20.9
	Saint John, N.B. (CMA)	114 048	16.0	19 897	5.6
	Moncton, N.B. (CA) (part)	97 513	13.7	18 931	5.3
	Fredericton, N.B. (CA) (part)	64 336	9.0	21 733	6.1
	Halifax, N.S. (CMA) (part)	16 789	2.4	13 344	3.8
St. Lawrence River	Major Urban Areas (50 000 +)	4 050 581	72.0	225 848	21.4
	Montréal, Qué. (CMA)	2 828 349	50.3	72 539	6.9
	Québec, Qué. (CMA)	576 075	10.2	50 288	4.8
	Chicoutimi-Jonquière, Qué. (CMA)	135 172	2.4	23 358	2.2
	Sherbrooke, Qué. (CA)	117 324	2.1	17 257	1.6
	Trois-Rivières, Qué. (CMA)	111 453	2.0	8 220	0.8
	Shawinigan, Qué. (CA)	62 699	1.1	10 500	1.0
	Saint-Jean-sur-Richelieu, Qué. (CA)	60 710	1.1	9 969	0.9
	Drummondville, Qué. (CA)	54 679	1.0	14 424	1.4
	Cornwall, Ont. (CA)	53 405	0.9	6 034	0.6
	Kingston, Ont. (CA) (part)	50 715	0.9	13 259	1.3
Ottawa River	Major Urban Areas (50 000 +)	719 886	55.4	75 358	19.4
	Ottawa-Hull, Ont./Qué. (CMA)	717 978	55.3	74 350	19.2
	North Bay, Ont. (CA) (part)	1 908	0.1	1 008	0.3
Lake Ontario Shore	Major Urban Areas (50 000 +)	4 090 511	89.9	188 674	45.7
	Toronto, Ont. (CMA) (part)	2 952 537	64.9	85 947	20.8
	Hamilton, Ont. (CMA) (part)	529 436	11.6	33 793	8.2
	St. Catharines-Niagara, Ont. (CMA)	304 353	6.7	23 569	5.7
	Oshawa, Ont. (CMA)	154 217	3.4	7 637	1.8
	Peterborough, Ont. (CA)	85 701	1.9	20 054	4.9
	Kingston, Ont. (CA) (part)	64 267	1.4	17 674	4.3
Lake Erie and Lake St. Clair Shore	Major Urban Areas (50 000 +)	1 014 340	62.6	86 894	22.1
	Kitchener, Ont. (CMA)	287 801	17.8	13 035	3.3
	London, Ont. (CMA)	283 668	17.5	23 225	5.9
	Windsor, Ont. (CMA)	246 110	15.2	24 699	6.3
	Brantford, Ont. (CA)	88 330	5.4	6 530	1.7
	Guelph, Ont. (CA)	78 456	4.8	7 249	1.8
	Sarnia, Ont. (CA) (part)	17 316	1.1	4 275	1.1
	Hamilton, Ont. (CMA) (part)	12 659	0.8	7 881	2.0
Lake Huron Shore	Major Urban Areas (50 000 +)	448 469	42.7	56 624	14.9
	Sudbury, Ont. (CMA)	149 923	14.3	14 977	3.9
	Sault Ste. Marie, Ont. (CA) (part)	69 001	6.6	7 582	2.0
	Sarnia, Ont. (CA) (part)	66 635	6.3	4 453	1.2
	Barrie, Ont. (CA)	61 271	5.8	10 837	2.8
	North Bay, Ont. (CA) (part)	55 229	5.3	4 889	1.3
	Toronto, Ont. (CMA) (part)	46 410	4.4	13 886	3.6
Lake Superior Shore	Major Urban Areas (50 000 +)	139 340	77.2	16 882	47.7
	Thunder Bay, Ont. (CMA)	121 379	67.3	12 014	34.0
	Sault Ste. Marie, Ont. (CA) (part)	17 961	10.0	4 868	13.8
Hudson Bay and Ungava Bay Basin	Major Urban Areas (50 000 +)	2 153 165	50.1	63 459	5.2
Lake Winnipeg Shore	Major Urban Areas (50 000 +)	462 283	56.9	19 059	7.5
	Winnipeg, Man. (CMA) (part)	462 283	56.9	19 059	7.5
Assiniboine River	Major Urban Areas (50 000 +)	286 872	40.7	3 815	1.6
	Regina, Sask. (CMA)	164 313	23.3	1 700	0.7
	Winnipeg, Man. (CMA) (part)	122 559	17.4	2 115	0.9

Table 2.1.10
Population of Major Urban Areas¹ by Major Drainage Area, 1981 (concluded)

Major Drainage Area	Major Urban Area	Urban Area Population	Urban Area Population as a Percentage of Drainage Area Population	Rural Fringe ² Population	Rural Fringe Population as a Percentage of Drainage Area Rural Population
Saskatchewan River	Major Urban Areas (50 000 +)	1 404 010	57.7	40 585	7.2
	Edmonton, Alta. (CMA)	657 057	27.0	40 585	7.2
	Calgary, Alta. (CMA)	592 743	24.4	0	0
	Saskatoon, Sask. (CMA)	154 210	6.3	0	0
Pacific Ocean Basin	Major Urban Areas (50 000 +)	1 769 382	65.5	135 349	23.1
Columbia River	Major Urban Areas (50 000 +)	77 468	22.6	21 111	15.6
	Kelowna, B.C. (CA)	77 468	22.6	21 111	15.6
Fraser River	Major Urban Areas (50 000 +)	1 156 459	78.9	84 843	34.4
	Vancouver, B.C. (CMA) (part)	1 023 903	69.9	66 178	26.8
	Prince George, B.C. (CA)	67 559	4.6	8 404	3.4
	Kamloops, B.C. (CA)	64 997	4.4	10 261	4.2
Pacific Ocean, South Coastal	Major Urban Areas (50 000 +)	535 455	68.2	29 395	18.7
	Vancouver, B.C. (CMA) (part)	244 280	31.1	5 372	3.4
	Victoria, B.C. (CMA)	233 481	29.7	13 663	8.7
	Nanaimo, B.C. (CA)	57 694	7.3	10 360	6.6
Canada	Major Urban Areas (50 000 +)	15 182 551	62.4	997 754	16.9

¹ The major urban areas include all Census Metropolitan Areas as well as all Census Agglomerations of 50,000 population or more in 1981. For a detailed explanation of 1981 Census Metropolitan Areas and Census Agglomerations, refer to the 1981 Census Dictionary, Catalogue 99-901, May 1982. Also note: Several of these urban areas are split and appear in more than one Major Drainage Area.

² The rural fringe population is the population living in the rural parts of the CA or CMA. The rural population refers to persons living outside population concentrations 1,000 or more with a population density of 400 or more per square kilometre.

Source:

Statistics Canada, Census of Population, 1981, special tabulations by the Office of the Senior Adviser on Integration.

Table 2.1.11
Experienced¹ Labour Force² by Major Drainage Area, 1971 and 1981³

Major Drainage Area	Experienced Labour Force									
	All Industries		Agriculture		Forestry		Fishing and Trapping		Mines, Quarries and Oil Wells	
	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981
Atlantic Ocean Basin	6 122 900	8 278 070	221 565	239 565	37 720	49 940	20 115	28 145	67 730	76 105
Atlantic Ocean Coastal	249 360	350 310	2 075	2 725	3 120	4 450	7 210	10 110	4 760	6 625
Gulf of St. Lawrence Coastal	332 495	462 250	14 880	14 455	10 730	13 030	9 960	12 985	13 335	18 250
Bay of Fundy Coastal and Saint John River	236 025	310 175	10 870	11 765	6 510	8 115	1 405	2 185	1 440	1 915
St. Lawrence River	1 954 215	2 652 070	64 010	68 570	9 410	11 320	220	425	10 930	11 895
Ottawa River	459 020	642 430	18 820	19 445	4 100	6 200	80	375	6 460	6 440
Lake Ontario Shore	1 809 250	2 454 125	29 310	34 630	540	1 295	395	520	5 475	6 640
Lake Erie and Lake St. Clair Shore	642 040	819 900	52 775	58 995	260	320	510	875	1 760	2 100
Lake Huron Shore	371 575	495 960	28 340	28 190	1 145	2 120	235	420	21 535	20 340
Lake Superior Shore	68 920	90 850	685	790	1 905	3 090	100	250	2 035	1 900
Hudson Bay and Ungava Bay Basin	1 505 640	2 182 205	218 130	192 945	7 525	11 305	1 000	1 875	49 745	92 420
Hudson Bay and Ungava Bay Coastal	92 810	131 355	5 075	4 205	3 785	5 310	540	310	11 110	13 415
Nelson River	11 470	10 760	15	30	10	135	45	70	3 940	2 360
Lake Winnipeg Shore	325 135	399 140	36 720	32 060	2 325	3 125	240	950	3 765	3 400
Assiniboine River	289 990	341 955	64 870	54 285	165	235	20	85	3 725	5 230
Saskatchewan River	786 235	1 298 995	111 450	102 365	1 240	2 500	155	460	27 205	68 015
Arctic Ocean Basin	93 700	165 670	16 295	16 330	2 015	3 235	470	410	6 740	19 500
Mackenzie River	91 370	161 690	16 295	16 320	2 015	3 235	320	325	6 725	19 220
Arctic Ocean Coastal	2 330	3 980	0	10	0	0	150	85	15	280
Pacific Ocean Basin	898 650	1 373 130	21 390	29 355	27 110	36 320	3 840	6 415	14 735	21 845
Columbia River	99 875	161 085	5 630	7 185	3 015	4 725	15	60	5 015	8 215
Fraser River	486 570	753 360	12 705	17 770	9 215	12 790	1 415	2 090	5 050	7 350
Yukon River	7 715	12 495	5	85	70	55	25	30	1 165	1 335
Pacific Ocean, North Coastal	29 595	43 410	395	415	2 815	3 305	450	735	970	1 785
Pacific Ocean, South Coastal	274 895	402 780	2 655	3 900	11 995	15 445	1 935	3 500	2 535	3 160
Gulf of Mexico Basin	6 010	6 250	3 645	3 060	5	0	0	0	75	145
Missouri River	6 010	6 250	3 645	3 060	5	0	0	0	75	145
Canada	8 626 925	12 005 320	481 190	481 275	74 380	100 765	25 440	36 870	139 035	210 020

Table 2.1.11
Experienced¹ Labour Force² by Major Drainage Area, 1971 and 1981³ (concluded)

Major Drainage Area	Experienced Labour Force											
	Manufacturing Industries		Construction		Service Sector ⁵		Industry Unspecified or Undefined		Ratio of Resource Base Industries ⁴ to All Industries		Ratio of Resource Base Industries to All Good Producing Industries ⁶	
	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981
Atlantic Ocean Basin	1 407 015	1 799 125	375 430	454 315	3 503 030	5 354 225	490 095	276 650	8.6	7.2	22.8	21.9
Atlantic Ocean Coastal Gulf of St. Lawrence Coastal Bay of Fundy Coastal and Saint John River	27 780	44 215	19 495	21 655	165 495	248 890	19 425	11 640	12.9	14.1	45.9	53.0
St. Lawrence River	52 535	78 745	28 310	32 410	173 610	275 525	29 135	16 850	25.9	23.9	60.6	62.7
Ottawa River	34 785	46 185	16 255	21 745	147 185	207 815	17 575	10 450	14.8	13.5	45.4	43.9
Lake Ontario Shore	478 825	603 985	102 540	129 810	1 104 805	1 725 210	183 475	100 855	6.8	5.3	18.1	16.4
Lake Erie and Lake St. Clair Shore	52 100	69 205	29 170	33 185	310 085	485 070	38 205	22 510	9.8	7.3	37.3	33.5
Lake Huron Shore	491 840	614 790	110 830	132 405	1 044 640	1 590 235	126 220	73 610	2.9	2.4	7.7	7.1
Lake Superior Shore	186 820	230 510	37 095	43 795	321 865	461 045	40 955	22 260	10.2	8.6	21.9	20.5
	68 515	92 855	27 425	34 255	194 150	302 165	30 230	15 615	18.3	12.9	42.5	34.8
	13 815	18 635	4 310	5 055	41 195	58 270	4 875	2 860	17.8	17.6	49.9	52.1
Hudson Bay and Ungava Bay Basin	149 325	214 445	93 020	179 390	875 405	1 420 545	111 490	69 280	21.1	15.2	56.7	46.5
Hudson Bay and Ungava Bay Coastal Nelson River Lake Winnipeg Shore Assiniboine River Saskatchewan River	10 005	15 620	4 510	8 440	47 310	76 750	10 475	7 305	34.1	28.0	80.1	73.5
	805	810	1 100	335	4 375	6 565	1 180	455	45.3	32.3	78.9	89.0
	49 770	60 225	18 435	21 740	190 260	264 910	23 620	12 730	16.0	11.9	43.4	38.0
	20 100	25 140	12 925	19 705	168 945	227 735	19 240	9 540	25.6	18.2	68.1	57.7
	68 645	112 650	56 050	129 170	464 515	844 585	56 975	39 250	19.7	14.1	54.4	42.8
Arctic Ocean Basin	5 460	10 750	7 270	15 210	46 200	93 830	9 250	6 405	34.1	28.8	75.2	70.1
Mackenzie River	5 365	10 645	7 195	15 045	44 770	90 675	8 685	6 225	34.6	29.3	75.4	70.3
Arctic Ocean Coastal	95	105	75	165	1 430	3 155	565	180	9.3	9.9	49.3	58.1
Pacific Ocean Basin	145 470	194 780	62 405	103 160	552 975	929 570	70 725	51 685	15.3	12.9	46.0	43.5
Columbia River	16 105	23 165	8 125	15 180	54 395	97 455	7 575	5 100	25.2	19.7	61.4	52.6
Fraser River	82 235	112 115	36 175	55 810	302 595	516 915	37 180	28 520	11.8	10.3	36.3	35.7
Yukon River	130	265	530	865	4 795	8 940	995	920	19.4	13.3	67.8	58.6
Pacific Ocean, North Coastal	7 300	10 235	1 550	2 585	13 510	22 730	2 605	1 620	42.0	36.9	84.0	80.9
Pacific Ocean, South Coastal	39 700	49 000	16 025	28 720	177 680	283 530	22 370	15 525	14.8	12.5	49.8	46.6
Gulf of Mexico Basin	40	250	110	290	1 755	2 210	380	295	66.2	53.8	96.1	85.6
Missouri River	40	250	110	290	1 755	2 210	380	295	66.2	53.8	96.1	85.6
Canada	1 707 335	2 219 375	538 220	752 365	4 979 385	7 800 315	681 940	404 335	11.8	9.7	31.7	29.5

The experienced labour force is derived by deleting from the total labour force, unemployed persons 15 years and over who had never worked or who had worked only prior to January 1, 1970 or January 1, 1980, as applicable.

The 1981 data were compiled as far as feasible in accordance with the 1971 Census definition of the labour force; the resulting universe however still reflects certain differences. First, women working less than 20 hours per week without pay on a family farm were included in 1981 but had been excluded in 1971. Second, the "looking for work" reference period was increased from one week in 1971 to four weeks in 1981.

Industry data for both years are based on the 1970 Standard Industrial Classification.

The resource base industries include the following: agriculture (SIC 001-021), forestry (SIC 031-039), fishing and trapping (SIC 041-047), mines, quarries and oil wells (SIC 051-099), fish product industries (SIC 102), fruit and vegetable processing industries (SIC 103), sawmills, planing mills and shingle mills (SIC 251), pulp and paper mills (SIC 271), smelting and refining (SIC 295).

⁵ Includes transportation, communication and other utilities (SIC 501-579), trade (SIC 602-699), finance, insurance and real estate (SIC 701-737), community, business and personal service industries (SIC 801-899), public administration and defence (SIC 902-991).

⁶ The all good producing industries include the primary and secondary industries. Please note that this ratio excludes the service sector industries.

Source:

Statistics Canada, Census of Population, 1971 and 1981, special tabulations.

Note:

The 1971 and 1981 figures have been random rounded. Since drainage area totals have been rounded independently, they may not add exactly to the Canada totals.

Table 2.1.12
Ecozone Socio-Economic Profile, 1971 and 1981

Characteristics	Ecozone							
	Atlantic Maritime		Mixed-Wood Plain		Boreal Shield		Prairie	
	1971	1981	1971	1981	1971	1981	1971	1981
Sex:								
Male	946 095	1 002 970	5 808 905	6 343 815	1 130 635	1 190 395	1 499 100	1 795 635
Female	934 200	1 015 605	5 914 595	6 593 930	1 075 980	1 161 880	1 482 980	1 782 565
Age Groups:								
0-14 years	592 040	484 805	3 325 065	2 761 925	758 480	608 495	883 635	827 695
15-24 years	369 705	396 485	2 158 130	2 430 760	435 390	476 105	552 150	723 955
25-64 years	754 330	925 715	5 312 555	6 484 685	874 480	1 078 700	1 280 675	1 678 535
65 years and over	164 225	211 560	927 750	1 260 375	138 265	188 980	265 625	348 020
Age Dependency Ratio ¹ (percent)	67.3	52.7	56.9	45.1	68.5	51.3	62.7	48.9
Mobility Status: Migrants ² (as a percentage of population age 5 and over)	18.1	17.1	23.6	21.2	20.0	17.4	23.7	23.7
Income ³ per Capita (1980 dollars)	4 318	6 448	6 376	8 677	4 620	6 824	5 545	9 057
Private Households, Total	469 585	629 240	3 347 790	4 482 330	527 910	709 570	875 265	1 249 325
Average Income ³ (1980 dollars)	16 647	20 331	21 804	24 747	18 581	22 238	18 348	25 563
Labour Force ⁴ , Total	671 835	906 435	4 961 835	6 695 530	743 425	1 039 285	1 288 215	1 889 575
Education(as a percentage of labour force):								
Less than Grade 9	33.6	17.0	27.5	13.6	35.1	18.0	23.2	9.9
University, without Degree	7.4	9.5	7.6	9.3	6.4	7.7	8.9	10.9
University Degree	5.5	9.1	7.4	11.3	4.4	7.2	6.9	11.1
Unemployment Rate (percent)	9.2	16.0	7.8	9.7	9.9	15.9	6.3	6.0
Experienced ⁵ Labour Force, Total	655 535	874 995	4 855 605	6 545 155	721 690	1 000 200	1 269 090	1 872 715
Percentage Distribution by Industry ⁶ :								
Agriculture	4.2	3.3	3.7	3.0	2.5	1.8	14.6	8.8
Forestry	2.2	2.1	0.2	0.2	2.9	2.9	0.1	0.1
Fishing and Trapping	1.8	1.7	--	--	1.0	1.1	--	--
Mines, Quarries and Oil Wells	1.7	1.5	0.4	0.3	7.4	5.5	2.1	3.6
Manufacturing Industries	14.7	14.8	25.1	23.3	15.1	16.3	10.0	9.8
Construction	7.3	6.7	5.7	5.2	7.7	6.5	6.2	8.5
Transportation	8.8	8.1	7.0	7.2	8.7	8.2	8.6	8.7
Trade	14.6	16.2	14.6	16.3	13.3	15.2	15.7	17.1
Finance	2.7	3.7	4.8	5.7	2.1	3.0	3.8	5.3
Services	23.2	28.4	23.7	28.5	23.0	28.1	24.2	27.8
Public Administration	10.9	10.2	7.0	7.0	7.0	7.6	7.7	7.4
Unspecified or Undefined	8.0	3.3	7.8	3.3	9.4	3.9	6.9	2.9
Ratio of Resource Base Industries ⁷ to All Industries (percent)	17.2	15.4	5.8	4.6	24.0	20.6	18.4	13.1
Ratio of Resource Base Industries to All Good Producing Industries ⁸ (percent)	49.7	49.5	15.4	13.8	59.5	58.2	51.8	41.4

Table 2.1.12
Ecozone Socio-Economic Profile, 1971 and 1981 (continued)

Characteristics	Ecozone							
	Boreal Plain		Montane Cordillera		Pacific Maritime		Boreal Cordillera	
	1971	1981	1971	1981	1971	1981	1971	1981
Sex:								
Male	267 490	317 610	262 055	354 390	824 710	993 815	10 430	13 580
Female	243 825	293 910	244 260	343 285	827 795	1 020 285	8 945	12 255
Age Groups:								
0-14 years	179 955	175 780	159 135	171 460	439 510	405 720	6 855	7 005
15-24 years	86 985	120 590	90 750	128 390	291 045	354 965	3 485	5 120
25-64 years	202 875	264 170	218 610	334 560	755 140	1 019 140	8 450	12 925
65 years and over	41 505	50 970	37 820	63 265	166 805	234 265	585	790
Age Dependency Ratio ¹ (percent)	76.4	58.9	63.7	50.7	58.0	46.6	62.3	43.2
Mobility Status:								
Migrants ² (as a percentage of population age 5 and over)	24.8	30.6	39.8	34.2	33.0	30.0	49.1	41.6
Income ³ per Capita (1980 dollars)	3 987	7 264	5 678	8 611	6 790	10 035	6 902	10 118
Private Households, Total	134 300	188 670	143 720	239 925	519 120	747 660	5 265	8 240
Average Income ³ (1980 dollars)	14 498	23 063	19 037	24 630	20 873	26 629	23 312	29 925
Labour Force ⁴ , Total	189 835	280 245	204 355	341 170	716 585	1 056 755	8 430	14 405
Education (as a percentage of labour force):								
Less than Grade 9	36.6	17.8	24.0	10.0	17.0	7.0	21.1	9.0
University, without Degree	6.2	7.2	8.4	9.7	10.4	13.3	9.0	12.0
University Degree	3.4	6.4	4.7	6.8	7.4	11.6	5.0	9.8
Unemployment Rate (percent)	5.4	8.4	8.8	11.1	9.0	8.4	6.9	10.9
Experienced ⁵ Labour Force, Total	187 535	277 050	200 795	335 740	700 395	1 042 680	8 335	14 250
Percentage Distribution by Industry ⁶ :								
Agriculture	26.7	16.1	4.9	3.9	1.7	1.6	0.9	1.2
Forestry	1.5	1.8	4.5	4.0	2.6	2.2	1.3	0.9
Fishing and Trapping	0.2	0.4	--	0.1	0.5	0.6	0.4	0.2
Mines, Quarries and Oil Wells	3.5	7.6	4.6	4.7	0.8	0.6	14.6	11.2
Manufacturing Industries	5.9	6.5	15.9	15.2	16.4	14.0	2.7	2.7
Construction	7.2	9.2	8.1	8.7	6.6	7.1	6.8	7.1
Transportation	7.1	7.7	9.3	8.0	9.5	9.0	14.1	11.9
Trade	11.0	13.8	14.5	16.1	16.7	17.2	10.7	12.4
Finance	1.7	3.0	2.9	3.8	5.1	6.0	2.2	3.3
Services	18.3	22.3	22.4	26.5	25.7	30.5	21.4	23.1
Public Administration	7.7	7.7	4.6	5.5	6.8	7.4	12.3	18.0
Unspecified or Undefined	9.0	4.0	8.3	3.6	7.7	3.8	12.7	7.7
Ratio of Resource Base Industries ⁷ to All Industries (percent)	38.1	29.7	26.8	22.6	12.1	10.0	21.3	16.0
Ratio of Resource Base Industries to All Good Producing Industries ⁸ (percent)	76.7	68.9	64.5	59.4	39.1	36.8	69.7	62.9

Table 2.1.12
Ecozone Socio-Economic Profile, 1971 and 1981 (continued)

Characteristics	Ecozone							
	Tundra Cordillera		Taiga Plain		Taiga Shield		Hudson Bay Plain	
	1971	1981	1971	1981	1971	1981	1971	1981
Sex:								
Male	960	685	7 055	8 080	22 565	29 010	5 530	5 070
Female	565	475	6 200	7 365	19 215	26 335	5 115	4 900
Age Groups:								
0-14 years	465	310	5 470	5 130	16 540	18 595	4 570	4 055
15-24 years	295	210	2 485	3 315	8 055	11 175	1 995	2 125
25-64 years	735 610	4 860	6 300	16 505	24 585	3 745	3 375	
65 years and over	30	35	440	695	680	990	340	420
Age Dependency Ratio ¹ (percent)	48.1	42.1	80.5	60.6	70.1	54.8	85.5	81.4
Mobility Status:								
Migrants ² (as a percentage of population age 5 and over)	52.7	42.0	36.2	29.7	42.2	34.4	25.2	15.8
Income ³ per Capita (1980 dollars)	7 481	10 115	4 423	6 603	6 270	8 642	3 990	4 090
Private Households, Total	315	305	2 855	3 905	8 800	14 895	2 095	2 110
Average Income ³ (1980 dollars)	20 743	28 126	18 634	24 525	24 824	30 755	17 421	18 849
Labour Force ⁴ , Total	710	585	4 060	6 385	15 395	25 000	3 245	2 985
Education (as a percentage of labour force):								
Less than Grade 9	24.6	16.2	35.1	21.5	24.6	13.0	32.5	30.2
University, without Degree	8.5	9.4	7.3	8.2	7.5	10.1	6.0	6.5
University Degree	4.9	8.5	5.0	8.1	5.4	10.1	4.0	6.7
Unemployment Rate (percent)	2.8	11.1	4.6	12.4	3.9	11.5	4.5	16.9
Experienced ⁵ Labour Force, Total	705	575	4 040	6 255	15 220	24 445	3 210	2 850
Percentage Distribution by Industry ⁶ :								
Agriculture	0	0	0.1	0.2	0.1	0.1	0	0.2
Forestry	0	0	3.2	1.8	1.2	0.3	0.6	2.1
Fishing and Trapping	0	0	2.4	1.6	0.7	1.6	1.1	0.4
Mines, Quarries and Oil Wells	60.3	55.7	13.1	11.4	27.5	28.7	0.2	0.9
Manufacturing Industries	0.7	0	2.7	3.5	1.2	1.3	0.8	0.9
Construction	5.7	2.6	5.6	7.4	3.8	4.3	4.4	5.1
Transportation	5.0	2.6	13.4	12.6	11.9	9.3	12.1	14.0
Trade	1.4	2.6	8.2	11.6	6.9	9.5	6.4	9.1
Finance	1.4	1.7	1.1	2.5	1.2	2.4	0.9	1.8
Services	11.3	13.0	20.7	22.2	15.9	22.3	27.1	32.1
Public Administration	1.4	7.8	16.6	19.3	14.3	13.9	24.3	18.6
Unspecified or Undefined	12.1	13.0	12.9	5.8	15.3	6.3	21.8	14.7
Ratio of Resource Base Industries ⁷ to All Industries (percent)	69.4	64.0	23.9	18.7	35.0	33.1	2.6	5.3
Ratio of Resource Base Industries to All Good Producing Industries ⁸ (percent)	91.5	95.5	76.7	67.5	85.7	85.6	28.9	48.1

Table 2.1.12
Ecozone Socio-Economic Profile, 1971 and 1981 (continued)

Characteristics	Ecozone							
	Southern Arctic		Northern Arctic		Arctic Cordillera		Canada	
	1971	1981	1971	1981	1971	1981	1971	1981
Sex:								
Male	5 400	7 505	4 080	5 240	365	490	10 795 370	12 068 290
Female	5 010	6 860	3 910	4 795	355	435	10 772 940	12 274 890
Age Groups:								
0-14 years	4 965	5 530	3 865	4 180	355	415	6 380 900	5 481 100
15-24 years	1 760	3 150	1 380	2 150	135	190	4 003 750	4 658 695
25-64 years	3 450	5 310	2 640	3 490	220	300	9 439 255	11 842 410
65 years and over	230	370	105	220	5	20	1 744 405	2 360 975
Age Dependency Ratio ¹ (percent)	99.7	69.7	98.8	78.0	101.4	88.8	60.4	47.5
Mobility Status:								
Migrants ² (as a percentage of population age five and over)	28.6	26.8	21.3	23.2	12.3	14.3	23.9	22.7
Income ³ per Capita (1980 dollars)	3 395	4 945	3 458	5 032	2 423	3 230	5 856	8 438
Private Households, Total	2 085	3 105	1 580	2 065	135	175	6 040 815	8 281 530
Average Income ³ (1980 dollars)	15 843	21 494	16 150	22 426	12 820	16 292	20 311	24 460
Labour Force ⁴ , Total	2 540	5 070	2 150	3 400	145	240	8 813 345	12 267 075
Education (as a percentage of labour force):								
Less than Grade 9	48.2	34.8	60.9	41.8	69.0	58.3	27.2	13.1
University, without Degree	5.9	7.4	6.0	6.6	6.9	4.2	7.9	9.7
University Degree	4.9	7.5	4.4	8.4	6.9	4.2	6.8	10.5
Unemployment Rate (percent)	6.7	18.4	2.8	12.4	0	22.9	7.9	10.0
Experienced ⁵ Labour Force, Total	2 505	4 910	2 140	3 300	145	225	8 626 925	12 005 320
Percentage Distribution by Industry ⁶ :								
Agriculture	0	0	0	0	0	0	5.6	4.0
Forestry	0.2	0	0	0	0	0	0.9	0.8
Fishing and Trapping	3.8	3.7	7.5	2.0	24.1	2.2	0.3	0.3
Mines, Quarries and Oil Wells	1.8	4.4	0.7	5.6	0	0	1.6	1.7
Manufacturing Industries	4.8	4.6	4.9	2.4	0	0	19.8	18.5
Construction	3.0	3.6	3.7	3.9	0	2.2	6.2	6.3
Transportation	8.2	10.1	6.8	10.5	3.4	8.9	7.8	7.8
Trade	11.0	9.9	7.7	12.1	10.3	11.1	14.7	16.3
Finance	0.6	3.5	0.2	3.2	0	4.4	4.2	5.2
Services	21.8	26.3	17.5	27.9	13.8	35.6	23.7	28.3
Public Administration	27.7	22.2	29.2	24.5	31.0	31.1	7.4	7.4
Unspecified or Undefined	17.4	11.7	21.3	8.2	10.3	2.2	7.9	3.4
Ratio of Resource Base Industries ⁷ to All Industries (percent)	7.5	11.8	10.4	8.3	26.9	2.3	11.8	9.7
Ratio of Resource Base Industries to All Good Producing Industries ⁸ (percent)	45.6	64.2	48.6	54.3	100.0	50.0	31.7	29.5

Table 2.1.12
Ecozone Socio-Economic Profile, 1971 and 1981 (concluded)

$$^1 \text{ Age Dependency Ratio} = \frac{(\text{Persons age 0-14 and 65 and over})}{(\text{Persons age 15-64})} \times 100$$

This variable indicates the relation between the size of the mostly non-working age population and that of the mostly working age population.

² Migrants are persons who, on Census day, were found to be residing in a Census Subdivision different from the one they were residing in five years earlier or were living outside Canada five years earlier. The mobility universe is the population 5 years of age and over residing in Canada on Census day. However, in this table inmates of institutions are excluded from the 1981 universe.

³ Income refers to the total money income received during calendar year 1970 or 1980, as applicable. In this table, the 1971 Census income sample covers all individuals 15 years and over, while the 1981 sample covers, the population 15 years and over, excluding the inmates of institutions. Also, income data for 1970 were inflated in terms of the 1980 purchasing power of the dollar. Thus, income data are presented in 1980 dollars.

⁴ The 1981 data were compiled as far as feasible in accordance with the 1971 Census definition of the labour force; the resulting universe however, still reflects certain differences. First, women working less than 20 hours per week without pay on a family farm were included in 1981 but had been excluded in 1971. Second, the "looking for work" reference period was increased from one week in 1971 to four weeks in 1981.

⁵ The experienced labour force is derived by deleting from the total labour force, unemployed persons 15 years and over who had never worked or who had worked only prior to January 1, 1970 or January 1, 1980, as applicable.

⁶ Industry data for both years are based on the 1970 Standard Industrial Classification.

⁷ The resource base industries include the following: agriculture (SIC 001-021), forestry (SIC 031-039), fishing and trapping (SIC 041-047), mines, quarries and oil wells (SIC 051-099), fish product industries (SIC 102), fruit and vegetable processing industries (SIC 103), sawmills, planing mills and shingle mills (SIC 251), pulp and paper mills (SIC 271), smelting and refining (SIC 295).

⁸ The all good producing industries include the primary and secondary industries. Note that this ratio excludes the service sector industries (ie. transportation, communication and other utilities (SIC 501-579), trade (SIC 602-699), finance, insurance and real estate (SIC 701-737), community, business and personal service industries (SIC 801-899), public administration and defence (SIC 902-991)).

Source:

Statistics Canada, Census of Population, 1971 and 1981, special tabulations.

Note:

The 1971 and 1981 figures have been random rounded. Since totals have been rounded independently, they do not necessarily equal the sum of individually rounded figures.

Harvesting



Contents

3.1	Agriculture	63
3.2	Forestry	105
3.3	Fisheries	123

Tables

3.1.3	Canada Land Inventory: Soil Capability for Agriculture	67
3.1.5	Farms and Farmland, 1901 to 1981	69
3.1.8	Indicators of Changing Agricultural Technology, 1901 to 1981	71
3.1.13	Production of Selected Major Field Crops by Ecozone, 1971, 1976 and 1981	74
3.1.16	Agricultural Land Use by Ecozone, 1981	77
3.1.18	Cropping Practices by Ecozone, 1981	80
3.1.21	Agricultural Land Use by Major Drainage Area, 1981	83
3.1.22	Cropping Practices by Major Drainage Area, 1981	84
3.1.23	Cropping Practices by Ecozone, 1971, 1976 and 1981	84
3.1.24	Monoculture Farms by Ecozone, 1971, 1976 and 1981	86
3.1.25	Monoculture Cropland Area by Ecozone, 1971, 1976 and 1981	87
3.1.26	Cropping Practices by Major Drainage Area, 1971, 1976 and 1981	88
3.1.27	Monoculture Farms by Major Drainage Area, 1971, 1976 and 1981	89
3.1.28	Monoculture Cropland Area by Major Drainage Area, 1971, 1976 and 1981	90
3.1.29	Number of Cattle and Pigs by Ecozone, 1971, 1976 and 1981	91
3.1.30	Number of Poultry by Ecozone, 1971, 1976 and 1981	92
3.1.31	Number of Cattle and Pigs by Major Drainage Area, 1971, 1976 and 1981	93
3.1.32	Number of Poultry by Major Drainage Area, 1971, 1976 and 1981	94
3.1.33	Fertilizer Application on Farmland by Ecozone, 1970 and 1980	95
3.1.34	Agricultural Pesticide Application on Farmland by Ecozone, 1970 and 1980	96
3.1.37	Fertilizer Application on Farmland by Major Drainage Area, 1970 and 1980	99
3.1.38	Agricultural Pesticide Application on Farmland by Major Drainage Area, 1970 and 1980	100
3.1.41	Socio-Economic Profile of Persons Employed in Agriculture by Ecozone, 1981	103
3.1.42	Economic Profile of Farms by Ecozone, 1980	104
3.2.5	Productivity and Status of Inventoried Forestland by Ecozone, 1981	110
3.2.6	Age Class of Stocked, Productive, Inventoried Forestland by Ecozone, 1981	111
3.2.7	Volume of Softwood Species on Stocked, Productive Forestland by Ecozone, 1981	112
3.2.8	Volume of Hardwood Species on Stocked, Productive Forestland by Ecozone, 1981	113
3.2.9	Forest Harvest by Province, 1954 to 1982	114
3.2.10	Annual Forest Harvest, Site Preparation and Planting	114
3.2.14	Area of Pest Control on Forestland	116
3.2.22	Socio-Economic Profile of Persons Employed in Forestry and the Logging Industry by Ecozone, 1981	122
3.3.16	Commercial Catch of Freshwater Fish, 1956 to 1983	136
3.3.17	Commercial Catch of Freshwater Fish in Ontario, 1962 to 1982	137
3.3.19	Persons Employed in the Fishing Industry, 1951 to 1983	139
3.3.20	Socio-Economic Profile of Fishermen, 1981	140

Maps

3.1.1	Canada Land Inventory Agricultural Soil Capability Classes One, Two and Three	64
3.1.4	Canadian Agroclimatic Resource Index	68
3.1.19	Wide-Row Cropland as a Percentage of Total Farmland, by Census Division, 1981	81
3.1.20	Close-Row Cropland as a Percentage of Total Farmland, by Census Division, 1981	82
3.1.35	Kilograms of Fertilizer per Hectare of Farmland, by Census Division, 1980	97
3.1.36	Percentage of Farmland Sprayed or Dusted with Pesticides, by Census Division, 1980	98
3.1.39	Water Erosion Risk	101
3.1.40	Wind Erosion Risk	102
3.2.2	Forest Types, 1981	107
3.2.3	Area of Stocked, Productive Forestland, 1981	108
3.2.16	Spread of Dutch Elm Disease in Canada, 1945 to 1982	118
3.2.17	Spruce Budworm Defoliation in Eastern Canada, 1972 and 1981	119

3.2.18	Tent Caterpillar Defoliation in Canada, 1982	119
3.3.2	Northwest Atlantic Fisheries Management Zones	125
3.3.12	Northeast Pacific Fisheries Management Zones	133

Charts

3.1.6	Improved Farmland by Region, 1901 to 1981	70
3.1.7	Average Size of Farm by Region, 1901 to 1981	70
3.1.9	Production of Cattle, 1901 to 1981	72
3.1.10	Production of Sheep, Horses and Pigs, 1901 to 1981	72
3.1.11	Production of Poultry, 1901 to 1981	72
3.1.12	Production of Selected Major Field Crops, 1923 to 1983	73
3.1.14	Nutrient Content of Fertilizers Sold, 1944 to 1975	75
3.1.15	Sales of Pest Control Products, 1949 to 1975	76
3.2.4	Inventoried Forestland in Relation to Ecozone Area, 1981	109
3.2.11	Area of Site Preparation as a Proportion of Area Harvested	115
3.2.12	Area of Planting and Seeding as a Proportion of Area Harvested	115
3.2.13	Method of Forest Harvest by Region	116
3.2.15	Estimated Forest Loss from Insects and Disease	117
3.2.19	Number of Forest Fires and Area Burned, 1918 to 1983	120
3.2.20	Number of Forest Fires by Cause	121
3.2.21	Area Burned by Forest Fires by Cause	121
3.3.3	Catch by Species Groups in the Northwest Atlantic, 1954 to 1982	126
3.3.4	Canadian Catch by Species Groups in the Northwest Atlantic, 1955 to 1984	126
3.3.5	Catch of Atlantic Cod in the Northwest Atlantic, 1931 to 1982	127
3.3.6	Catch of Atlantic Cod on the Canadian Continental Shelf, 1952 to 1982	127
3.3.7	Catch of Herring in the Northwest Atlantic, 1956 to 1982	128
3.3.9	Canadian Invertebrate Catch in the Northwest Atlantic, 1955 to 1984	130
3.3.10	Atlantic Lobster Catch, 1870 to 1984	131
3.3.11	Catch of Salmon in the Northwest Atlantic, 1960 to 1983	132
3.3.13	Catch by Species Groups in the Northeast Pacific, 1955 to 1980	134
3.3.14	Canadian Commercial Catch by Species Groups in the Northeast Pacific, 1955 to 1984	134
3.3.15	Catch of Groundfish in the Northeast Pacific, 1956 to 1983	135

Technical Boxes

3.1.2	Canada Land Inventory Soil Capability Classes	65
3.1.17	Cropping Practices: An Indicator of Environmental Stress	78
3.2.1	Canada's Forest Inventory	106
3.3.1	Fish Catch: An Indicator of Fish Stock	124
3.3.8	Gulf of St. Lawrence Herring Catch	129
3.3.18	Fish Catch: An Indicator of Change in the Great Lakes Ecosystem	138

3.1

Agriculture



Map 3.1.1.1
Canada Land Inventory Agricultural Soil Capability, Classes One, Two and Three¹



¹ Moderate to high capability for agriculture; see Technical Box 3.1.2 for additional information.

Sources:
Environment Canada, Lands Directorate, *Canada's Special Resource Lands*, by Wendy Simpson-Lewis et al., 1979.
British Columbia Environment and Land Use Committee Secretariat, *Agriculture Land Capability in British Columbia*, 1976.

Technical Box 3.1.2

The Canada Land Inventory Soil Capability Classes

The Canada Land Inventory Program involved the mapping and assessment of 2.5 million square kilometres in the settled areas of Canada, for agriculture, forestry, recreation, and wildlife capability as well as present land use. The information for the C.L.I. mapping was gathered between 1960 and 1968, and compiled usually at a scale of 1:50,000. The interpretation of land use was completed by field survey and air photo review.

Land capability refers to the ability of the land to accommodate a particular use or activity without permanent damage. Determination of capability involves interpreting climate, vegetation, soil, and other data. Seven classes of capability were established for each use. The following are the seven classes for agriculture. The first three are considered capable of sustained production of commonly cultivated crops, the fourth is marginal for arable cultivation, the fifth is capable of use only for permanent pasture and hay, the sixth is capable of use only for wild pasture, while the seventh class is for soils and land types considered incapable of use for arable cultivation or permanent pasture.

Class 1 Soils in this class have no significant limitations for crops;

These deep soils are level or have very gentle slopes, are well to imperfectly drained and have a good water-holding capacity;

They are easily maintained in good tilth and productivity, and damage from erosion is slight;

They are moderately high to high in productivity for a wide range of field crops adapted to the region.

Class 2 Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices;

These deep soils have a good water-holding capacity, can be managed with little difficulty and are moderately high to high in productivity for a fairly wide range of field crops;

The moderate limitations of these soils may be from any one of a number of factors including mildly adverse regional climate, moderate effects of erosion, poor soil structure or slow permeability, low fertility correctable with limited application of fertilizer and lime, gentle to moderate slopes, or occasional overflow or wetness.

Class 3 Soils in this class have moderately severe limitations that restrict the range of crops or

require special conservation practices;

Under good management these soils are fair to moderately high in productivity for a fairly wide range of field crops adapted to the region. Conservation practises are more difficult to apply and maintain.

Limitations arise from a combination of two of the factors described under Class 2, or from one of the following: moderate climatic limitations; moderately severe effects of erosion; an intractable soil mass or very slow permeability; low fertility; moderate to strong slopes; frequent overflow or poor drainage resulting in occasional crop damage; low water-holding capacity or a soil which is slow to release water; stoniness sufficiently severe to seriously handicap cultivation and necessitating some clearing; a restricted rooting zone; moderate salinity.

Class 4 Soils in this class have severe limitations that restrict the range of crops, or require special conservation practices, or both;

Such soils are suitable for only a few crops, or the yield for a range of crops is low, or the risk of crop failure is high;

Limitations include the adverse effects of a combination of two or more of those described in Classes 2 and 3, or one of the following: moderately severe climate; very low water-holding capacity; low fertility that is difficult or not feasible to correct; strong slopes; severe past erosion; a very intractable soil mass or extremely slow permeability; frequent overflow with severe effects on crops; severe salinity causing some crop failures; extreme stoniness requiring considerable clearing to permit annual cultivation; a very restricted rooting zone, but more than 30 centimetres of soil over bedrock; an impermeable layer;

Class 5 Soils in this class have very severe limitations that restrict their capability to produce perennial forage crops; improvement practices are feasible;

Soils have such serious soil, climatic, or other limitations that they are not capable of use for sustained production of annual field crops;

These soils may be improved by the use of farm machinery for the production of native or tame species of perennial forage plants;

Technical Box 3.1.2

The Canada Land Inventory Soil Capability Classes (concluded)

Limitations include the adverse effects of one or more of the following: severe climate; low water-holding capacity; severe past erosion; steep slopes; very poor drainage; very frequent overflow; severe salinity permitting only salt tolerant forage crops to grow; stoniness or shallowness of soil that makes annual cultivation impractical;

Some soils can be used for cultivated field crops provided unusually intensive management is carried out;

- Class 6** Soils in this class are only capable of producing perennial forage crops, and improvement practices are not feasible;
Soils have some natural sustained grazing capacity for farm animals but have such serious soil, climatic or other limitations as to make impractical the application of improvement practices that can be carried out on Class 5 soils;

Limitations include the adverse effects of one or more of the following: very severe climate; very low water-holding capacity; very steep slopes; very severely eroded land with gullies too numerous and too deep for working with machinery; severely saline land producing only salt-tolerant, native plants; very frequent overflow allowing less than 10 weeks effective grazing; water on the surface of the soil for most of the year; stoniness or shallowness of soil that makes any cultivation impractical.

- Class 7** Soils in this class have no capability for cultivation or permanent pasture;
All classified areas (except organic soils) not included in Classes 1 to 6 are placed in this class.

Source:

Environment Canada, Lands Directorate, *Canada's Special Resource Lands*, by Wendy Simpson-Lewis *et al.*, 1981.

Table 3.1.3
Canada Land Inventory: Soil Capability for Agriculture

	Soil Capability Classes							Organic ¹	Unclassed ²	Not Classi- fied by CLI	Total Land Area
	1	2	3	4	5	6	7				
	hectares										
Newfoundland	0	0	1 851	16 613	91 517	207 439	644 075	217 918	1 446 929	37 945 658	40 572 000
Prince Edward Island	0	261 561	141 519	49 776	76 064	0	27 716	6 686	181	2 497	566 000
Nova Scotia	0	166 317	982 877	424 410	82 215	14 325	3 516 041	116 301	860	245 654	5 549 000
New Brunswick	0	160 528	1 151 144	2 032 089	1 700 253	11 543	1 838 630	132 768	115 306	201 739	7 344 000
Quebec	19 556	907 106	1 277 202	2 580 503	1 658 600	10 671	20 599 589	1 516 902	132 117	125 465 754	154 068 000
Ontario	2 156 752	2 217 667	2 908 818	2 624 648	1 915 301	1 140 285	11 221 332	2 563 271	782 742	79 327 184	106 858 000
Manitoba	162 501	2 530 607	2 440 659	2 394 118	2 323 786	2 092 169	1 088 592	4 741 738	3 858 208	43 365 622	64 995 000
Saskatchewan	999 691	5 874 448	9 424 700	3 893 109	8 736 287	3 950 141	225 526	2 788 605	1 126 956	28 213 537	65 233 000
Alberta	786 527	3 837 093	6 105 329	9 279 576	11 093 057	3 930 670	4 191 398	5 991 972	2 658 857	18 244 521	66 119 000
British Columbia ³	21 057	235 474	692 026	1 701 678	6 671 675	5 419 073	15 254 812	...	...	64 784 205	94 780 000
Northwest Territories and Yukon ⁴	..	..	..	..	..	..	..	..	..	390 977 000	390 977 000
Total	4 146 084	16 190 801	25 126 125	24 996 520	34 348 755	16 776 316	58 607 711	18 076 161	10 122 156	722 872 032	997 061 000

¹ Organic soils are peatlands, bogs and marshes capable of supporting agricultural production and can be distinguished from mineral soils by their high organic content.

² Unclassed lands are unmapped areas, water, forest reserves, national parks, urban areas, provincial parks.

³ In British Columbia, organic soils are not separately identified and have been classified to equivalently rated mineral soils.

⁴ Not covered by Canada Land Inventory.

Source:

Environment Canada, Lands Directorate, *Agricultural Land Use Change in Canada*, by J.D. McCuaig and E.W. Manning, Catalogue 73-1/21E, 1982.

Map 3.1.4

Canadian Agroclimatic Resource Index

Agroclimatic Resource Index Value

	0.0 < 1.0
	1.0 < 2.0
	2.0 < 2.5
	2.5 < 3.0
	> 3.0

**Source:**

G.D.V. Williams, Agriculture Canada, as published in Environment Canada, *Canada's Special Resource Lands*, by Wendy Simpson-Lewis *et al.*, 1979.

Note:

The agroclimatic resource index was developed to offer a geographical evaluation of critical climatic parameters affecting agriculture. Williams reasoned that length of frost-free period was of prime importance and therefore this forms the basic element of the index. The index is based on the number of frost-free days divided by 60 (ie. minimum growing period). Adjustments were then made to the index to account for two other important types of climatic restrictions on agriculture. In regions with a significant shortage of moisture such as in the drier part of the Prairies and some interior valleys of British Columbia, the index was modified downward, by applying Sly's data on moisture index (Agriculture Canada, 1976), to reflect the degree of moisture limitation. On the other hand, some coastal locations have a different climatic shortcoming. In spite of a long frost-free season, summer heat may be inadequate for crops requiring a long growing season to fully mature. Therefore, utilizing growing degree-day information, the agroclimatic index was again altered downward to reflect the lack of sufficient summer heat in coastal areas. The resulting agroclimatic index, ACRI, has values which vary from 1.0 in the north (agricultural frontier areas) to 3.0 in the south near Windsor, Ontario.

310 0 310 620 kilometres

Table 3.1.5
Farms and Farmland, 1901 to 1981¹

	Improved Farmland				Other	Total Improved Farmland	Unimproved Farmland			Total Farmland	Number of Farms	Average Farm Size	
	Cultivated Land ²			Woodland			Other	Total Unimproved Farmland					
	Cropland	Improved Pasture	Summer Fallow						Total Cultivated Land				
millions of hectares												number	hectares
1901	8.1	0	..	8.1	..	12.2	6.8	6.7	13.5	25.7	511.1	50.3	
1911	14.4	0	1.0	15.4	..	19.7	7.1	17.3	24.4	44.1	682.8	64.5	
1921	20.2	3.1	4.8	28.1	0.4	28.6	9.6	18.7	28.4	57.0	711.1	80.2	
1931	23.6	3.2	6.8	33.6	1.0	34.7	10.8	20.5	31.3	66.0	728.6	90.6	
1941	22.8	3.4	9.5	35.7	1.3	37.1	9.0	24.1	33.1	70.2	732.9	95.8	
1951	25.2	4.0	8.9	38.1	1.1	39.2	9.2	22.0	31.2	70.4	623.1	113.1	
1961	25.3	4.1	11.4	40.8	1.0	41.8	6.8	21.0	28.0	69.8	480.9	145.2	
1971	27.8	4.1	10.8	42.7	1.0	43.8	4.6	20.2	25.0	68.7	366.1	187.5	
1976	28.3	4.1	10.9	43.3	0.9	44.2	4.4	19.8	24.2	68.4	338.6	202.6	
1981	30.9	4.4	9.7	45.0	1.0	46.1	3.5	16.2	19.8	65.9	318.4	207.0	

¹ For Census years before 1961, the definition of a Census Farm was "an agricultural holding of more than three acres, or a farm of one to three acres with \$250.00 or more in sales." From the 1961 Census to the 1976 Census, the definition of a Census Farm was changed to "an agricultural holding of one acre or more with sales of \$50.00 or more." In 1981 the definition was changed to "an agricultural holding with sales of products of \$250.00 or more."

² Cultivated Land is land under crops, improved pasture (i.e. maintained grasslands) or in fallow.

Sources:
Statistics Canada, *Handbook of Agricultural Statistics Catalogue* 21-503, August 1955, for Census data before 1961.
Statistics Canada, *Census of Agriculture*, for years 1961, 1971 and 1981.

Notes:

Improved Land

The area of improved land consists of the total of the areas reported for the following four land categories: cropland, improved pasture, summerfallow and other improved land.

(i) Cropland - Included in this item is the total area of land sown for harvest in the Census year. Cropland includes the total area of all field crops, plus the areas of fruits, vegetables, greenhouses, mushroom houses and nursery products. The sum of the individual crops is not necessarily equal to cropland since occasionally two crops may be harvested from the same land in one year; also, crops reported in fractions of acres are rounded.

(ii) Improved pasture - All land which was being used for pasture or grazing and which has had some improvements made to it in recent years is included. Improvements include cultivation, drainage, irrigation, fertilization, seeding or spraying.

(iii) Summerfallow - Land normally in crops but from which no crop was harvested during the Census year. The land may have been cultivated or sprayed during the year to control weeds.

(iv) Other improved land - This item includes the area of barnyards, home gardens, lanes and roads on farms. It also includes areas of cultivated land that were lying idle, being neither summerfallowed nor cropped, and newly broken land that had not been seeded to a crop.

Unimproved Land

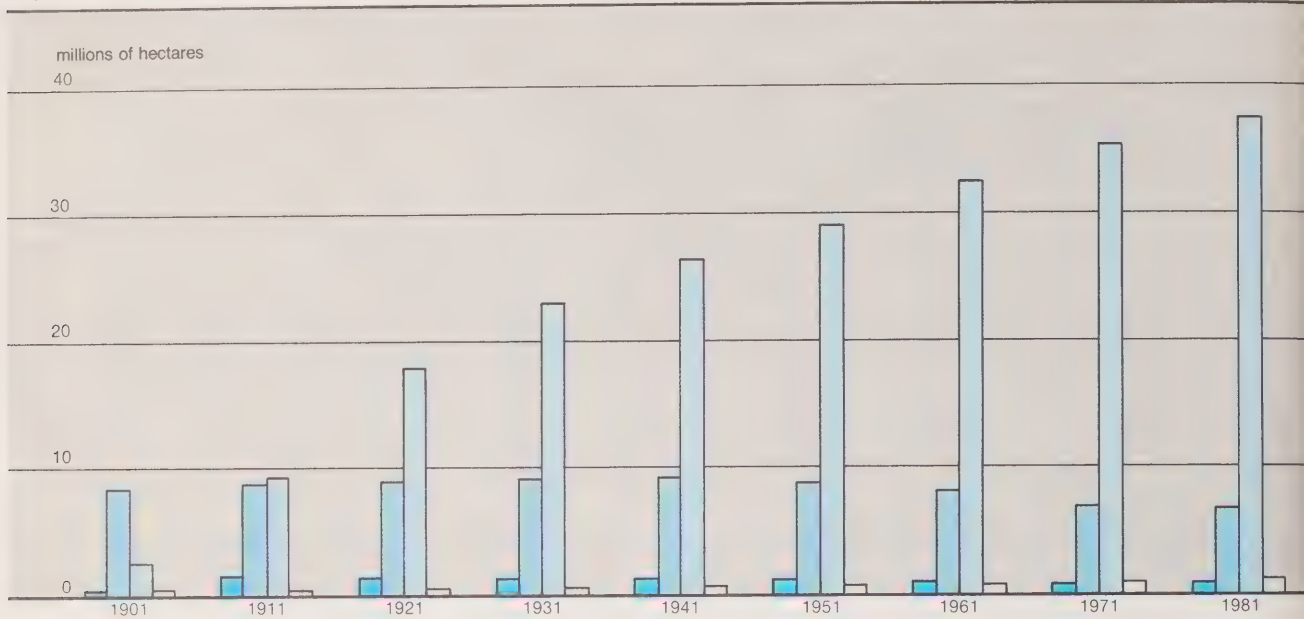
The area of unimproved land consists of the total areas reported as woodland and other unimproved land.

(v) Woodland - This includes farm woodlots, land leased for cutting, sugar bush and cut-over land with young growth which has or will have value as timber, fuelwood or Christmas trees. The area of trees planted for wind-breaks is also included. It excludes large tracts of timber which are run as a separate business from the farm.

(vi) Other unimproved land - Areas of native pasture or hay land that had not been cultivated, brush pasture, grazing or waste land, sloughs, marsh and rocky land are all included in this item.

It should also be noted that individual items may not add to totals due to rounding.

Chart 3.1.6
Improved Farmland by Region, 1901 to 1981



Sources:

Statistics Canada, *Handbook of Agricultural Statistics*, Catalogue 21-503, August 1955 for Census data before 1961.

Statistics Canada, *Census of Agriculture*, for years 1961, 1971 and 1981.

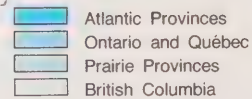
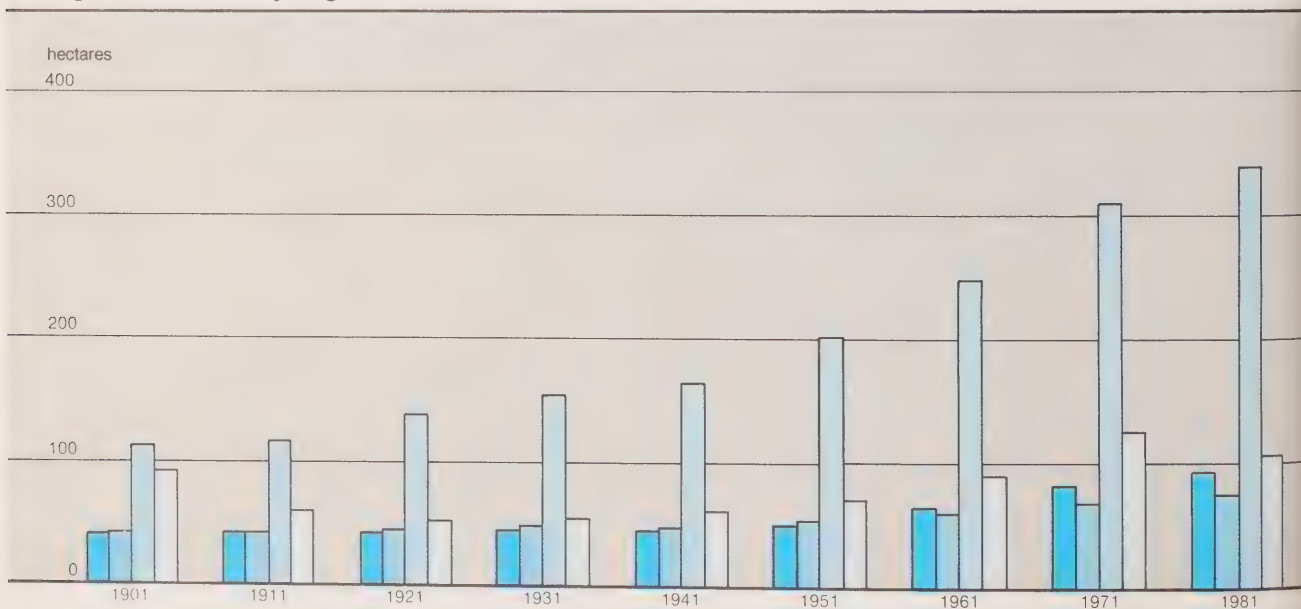


Chart 3.1.7
Average Size of Farm by Region, 1901 to 1981



Sources:

Statistics Canada, *Handbook of Agricultural Statistics*, Catalogue 21-503, August 1955 for Census data before 1961.

Statistics Canada, *Census of Agriculture*, for years 1961, 1971 and 1981.

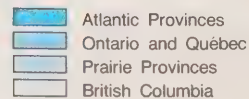


Table 3.1.8
Indicators of Changing Agricultural Technology, 1901 to 1981

	Total Farmland	Cropland	Labour Force ¹	Fertilizers ²	Tractors ³ and Combines	Number of Workers	Tonnes of Fertilizers	Number of Tractors and Combines
	millions of hectares		thousands of workers	thousands of tonnes	number	per thousand hectares of farmland	per thousand hectares of cropland	
1901	25.7	8.1	718	..	..	27.9	..	..
1911	44.1	14.4	928	..	..	21.0	..	..
1921	57.0	20.2	1 025	..	47 455	18.0	..	2
1931	66.0	23.6	1 118	254	114 227	16.9	11	5
1941	70.2	22.8	1 074	289	178 765	15.3	13	8
1951	70.4	25.2	826	688	490 186	11.7	27	19
1961	69.8	25.3	649	961	705 400	9.3	38	28
1971	68.7	27.8	510	1 885	759 449	7.4	68	27
1976	68.4	28.3	489	2 737	798 615	7.1	97	28
1981	65.9	30.9	508	3 501	818 716	7.7	113	26

Includes workers 10 years old and over in 1901 and 15 years old and over in all other years.

Fertilizers refers to applications of commercial fertilizer only and not applications of manure produced on the farm. Up to 1978 these data were obtained from the "Annual Fertilizer Dealer Survey" which includes all fertilizer for sale by dealers. A small amount of this fertilizer was for non-agricultural uses (i.e. household, institution and governments). The 1981 quantity of fertilizers is obtained from the Census of Agriculture, therefore, the 1981 figure is not necessarily comparable to those of the previous years.

³ Includes only tractors in 1921.

Sources:

Statistics Canada, *1921 Census of Canada*, Volume IV.
 Statistics Canada, *1961 Census of Canada*, Volume III.
 Statistics Canada, *Fertilizer Trade*, Catalogue 46-207, various issues
 Statistics Canada, *1971 Census of Agriculture*, Volume IV.
 Statistics Canada, *The Labour Force*, January 1971, Catalogue 71-001.
 Statistics Canada, *Labour Force Annual Averages, 1975-78*, Catalogue 71-529

Chart 3.1.9
Production of Cattle,¹ 1901 to 1981

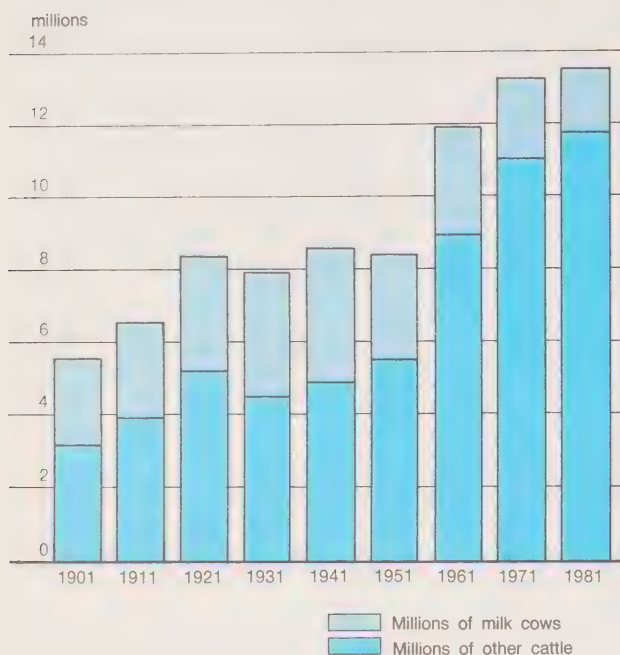


Chart 3.1.11
Production of Poultry¹, 1901 to 1981

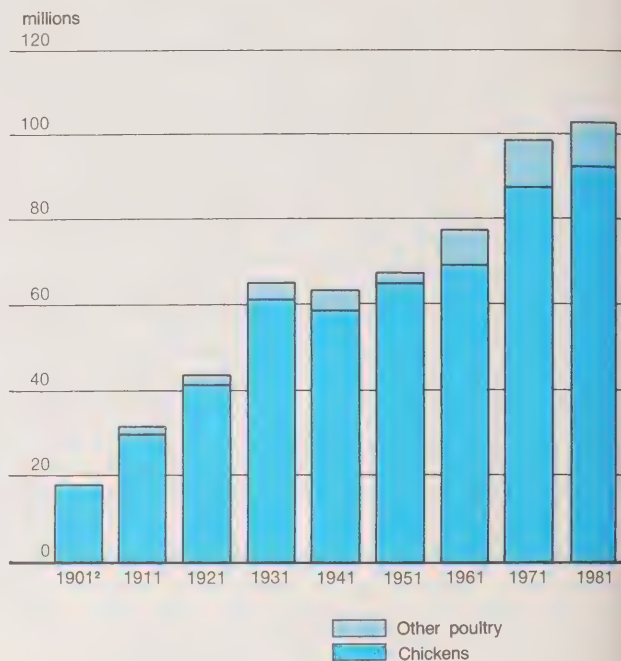
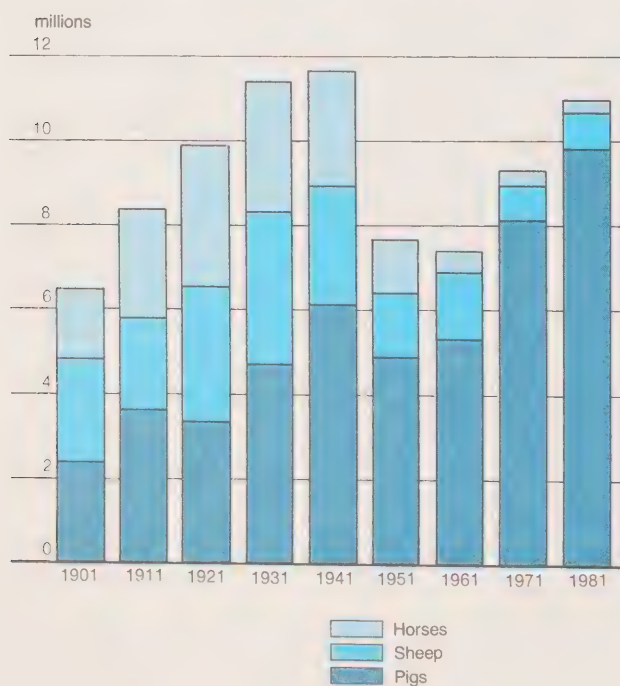


Chart 3.1.10
Production of Sheep, Horses and Pigs,¹ 1901 to 1981



¹ Includes only animals on Census farms.

² Other poultry and chickens were not separated in 1901.

Sources:

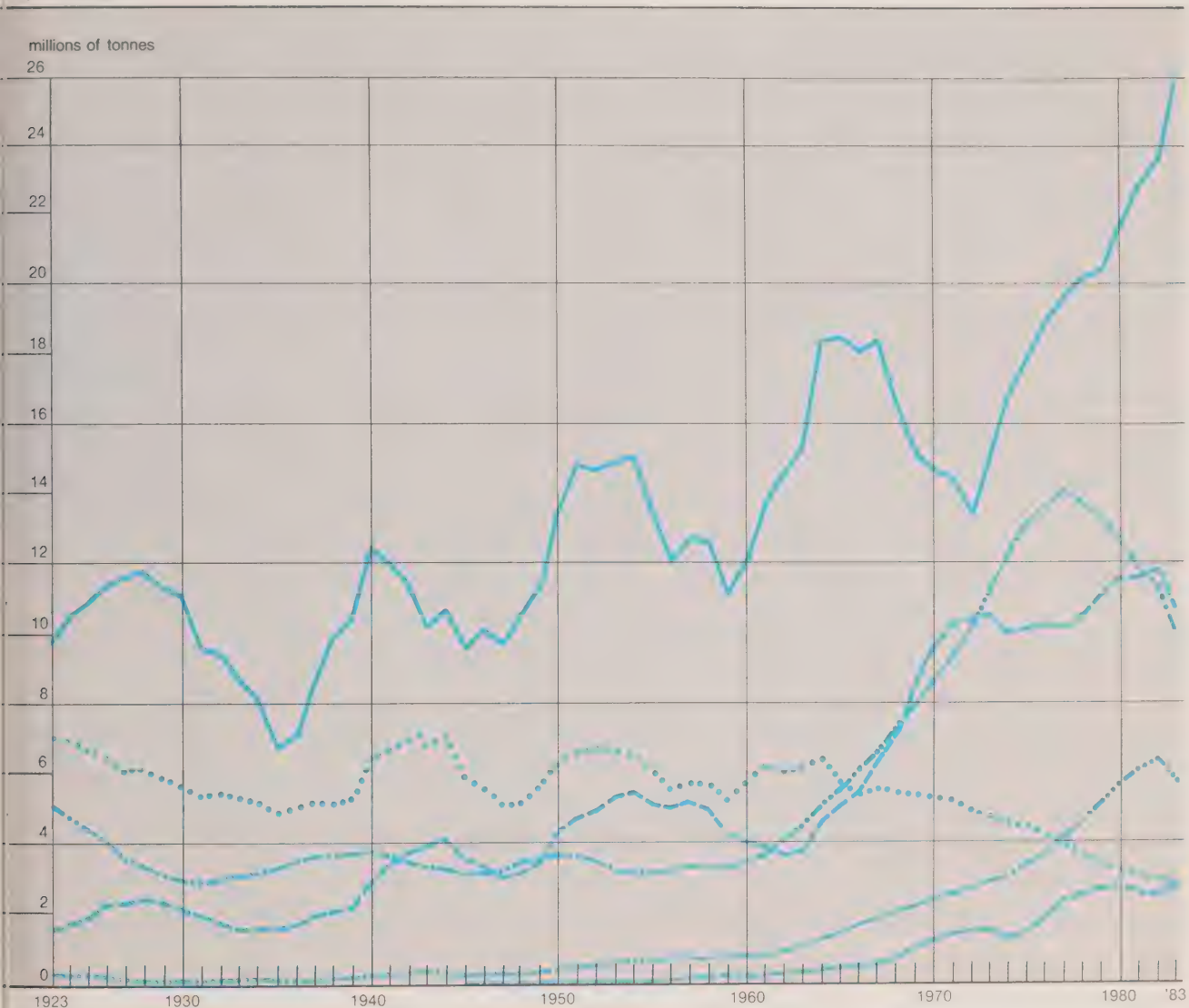
Statistics Canada, 1941 Census of Canada, Volume I.

Statistics Canada, 1951 Census of Canada, Volume VI.

Statistics Canada, 1971 Census of Agriculture, *Agriculture: Canada*, Catalogue 96-701.

Statistics Canada, 1981 Census of Agriculture, *Agriculture: Canada Catalogue* 96-901.

Chart 3.1.12
Production of Selected Major Field Crops, 1923 to 1983
 (in millions of tonnes, average year averages)



Sources:
 Statistics Canada, *Handbook of Agricultural Statistics, part 1, Field Crops 1921-1974*, Catalogue 21-516, 1977.
 Statistics Canada, *Handbook of Field Crop Area, Yield Production, Average Farm Price and Value, 1953-1983*, working document, August 1984.

—••— Fodder corn —•••— Rapeseed
 —•••— Corn for grain ••••• Oats for grain
 — Wheat — Barley

Table 3.1.13
Production of Selected Major Field Crops by Ecozone, 1971, 1976, and 1981

Ecozone	Close-Row Crops								
	Wheat			Oats for Grain			Barley		
	1971	1976	1981	1971	1976	1981	1971	1976	1981
	tonnes			tonnes			tonnes		
Atlantic Maritime	17 745	33 373	31 169	84 868	147 025	120 419	40 562	49 897	106 976
Nova Scotia	5 089	4 409	8 491	11 397	15 453	14 080	7 120	4 790	9 362
New Brunswick	5 879	5 688	10 043	35 610	31 970	30 813	6 532	5 879	9 819
Prince Edward Island	6 777	20 276	9 036	37 861	48 302	29 009	26 911	33 530	60 005
Québec	..	3 000	3 600	..	51 299	46 517	..	5 698	27 789
Mixed-Wood Plain	392 914	738 300	846 545	514 039	530 424	408 490	439 933	355 236	742 293
Québec	..	54 301	113 603	..	244 097	187 166	..	25 993	213 019
Ontario	392 914	683 999	732 942	514 039	286 327	221 323	439 933	329 243	529 274
Boreal Shield	20 310	27 096	37 488	110 977	116 475	91 648	24 916	32 202	87 883
Québec	..	2 600	2 300	..	41 100	32 812	..	6 998	16 194
Ontario	1 766	391	..	63 135	59 545	48 302	13 478	13 869	54 271
Manitoba	18 544	24 106	35 188	47 843	15 831	10 534	11 438	11 335	17 419
Prairie	12 794 433	20 532 304	21 106 821	3 610 257	3 097 690	1 901 726	10 246 337	719 752	9 677 419
Manitoba	1 887 325	2 649 592	3 038 399	1 020 118	825 305	388 727	1 862 937	1 369 734	2 094 610
Saskatchewan	8 748 392	13 413 588	12 598 161	1 315 026	1 045 711	612 593	4 467 270	1 953 153	2 236 687
Alberta	2 158 715	4 469 124	5 470 260	1 275 114	1 226 674	900 405	3 916 130	3 876 865	5 346 122
Boreal Plain	1 157 143	2 255 650	2 780 452	863 351	939 425	666 322	2 313 388	2 876 082	3 109 531
Manitoba	108 082	129 503	252 152	104 125	99 622	63 403	172 233	77 684	217 622
Saskatchewan	640 970	1 582 168	1 689 998	396 832	342 281	204 780	1 019 383	1 007 898	1 094 495
Alberta	317 899	484 105	751 213	282 523	408 073	348 788	960 895	1 609 788	1 621 057
British Columbia	90 192	59 874	87 090	79 871	89 448	49 351	160 877	180 711	176 357
Canada	14 411 900	23 586 674	24 802 200	5 640 093	4 831 542	3 188 300	13 099 300	10 513 700	13 724 200
Ecozone	Wide-Row Crops								
	Corn for Grain			Fodder Corn			Soybeans		
	1971	1976	1981	1971	1976	1981	1971	1976	1981
	tonnes			tonnes			tonnes		
Atlantic Maritime	..	..	..	..	401 000	235 000	0	0	0
Nova Scotia	..	..	..	..	168 000	98 000	0	0	0
New Brunswick	..	..	..	..	75 000	54 000	0	0	0
Prince Edward Island	..	..	..	..	158 000	83 000	0	0	0
Québec	..	..	..	..	..	..	0	0	0
Mixed-Wood Plain	2 591 331	3 758 300	5 539 000	9 443 000	13 434 410	10 648 900	279 800	250 400	606 800
Québec	..	331 300	303 000	1 607 000	3 309 410	2 876 900	0	0	0
Ontario	2 599 000	3 427 000	5 236 000	7 836 000	10 125 000	7 772 000	279 800	250 400	606 800
Boreal Shield	7 285	7 328	6 096	155 560	233 000	200 000	0	0	0
Québec	..	..	..	..	..	..	0	0	0
Ontario	7 285	7 328	6 096	155 560	233 000	200 000	0	0	0
Manitoba	..	..	..	..	..	..	0	0	0
Prairie	..	..	..	..	..	..	0	0	0
Manitoba	..	..	..	..	..	..	0	0	0
Saskatchewan	..	..	..	..	..	..	0	0	0
Alberta	..	..	..	..	..	..	0	0	0
Boreal Plain	..	..	..	..	..	..	0	0	0
Manitoba	..	..	..	..	..	..	0	0	0
Saskatchewan	..	..	..	..	..	..	0	0	0
Alberta	..	..	..	..	..	..	0	0	0
British Columbia	..	..	..	..	..	..	0	0	0
Canada	2 941 500	3 759 200	6 673 700	9 724 000	14 423 410	12 098 900	279 800	250 400	606 800

Source:

Statistics Canada, Agriculture Division, Handbook of Field Crop Area, Yield, Production, Average Farm Price and Value, 1953-1983, (working documents) August 1984

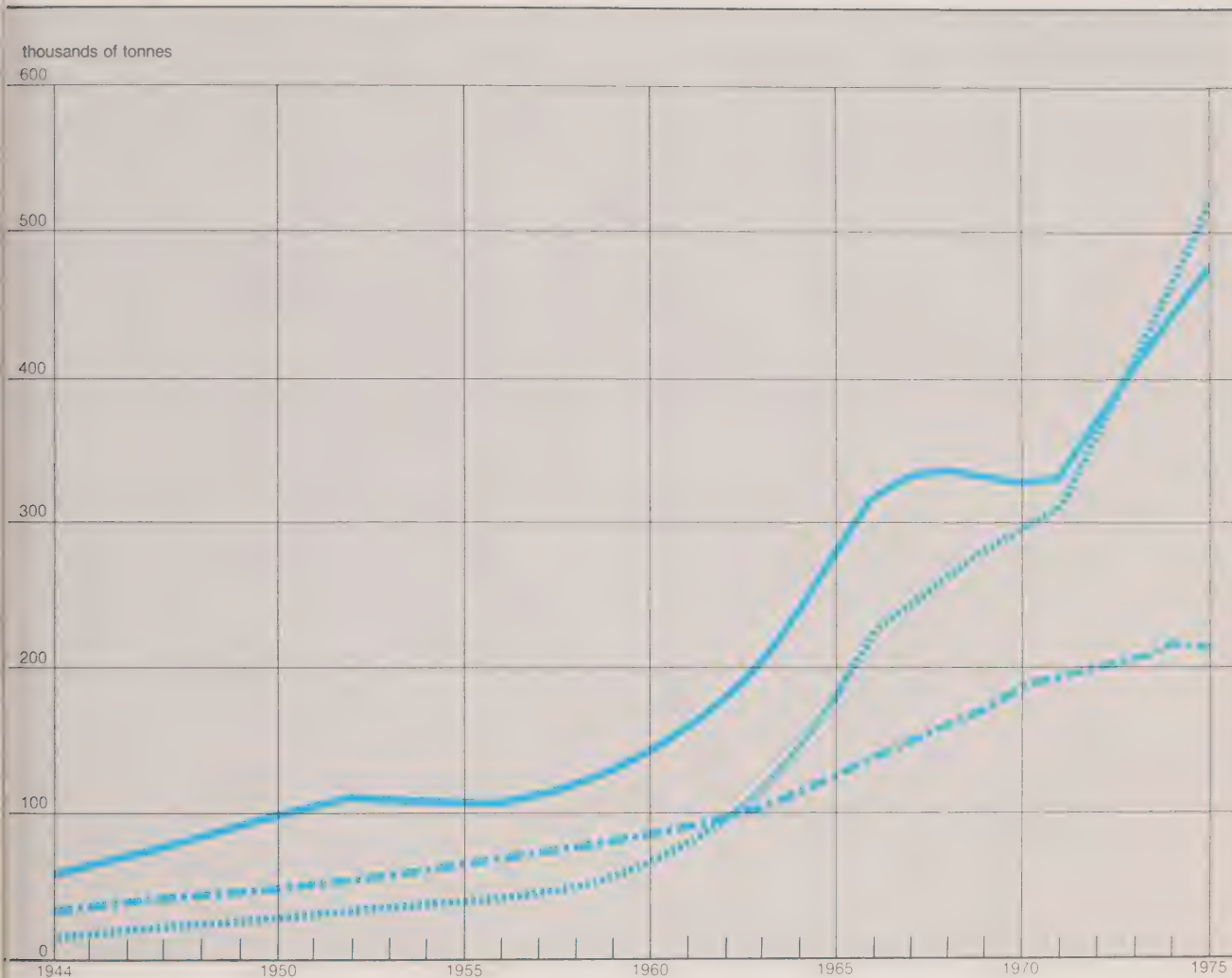
Statistics Canada, Agriculture Crop Production Statistics, special tabulations by Cansim Division.

Note:

This table was compiled from crop district and county level information. Where data are unavailable by crop district or county they are still included in the national totals. Generally these amounts are negligible for individual geographic units.

Close-row and wide-row crops have been differentiated according to environmental implications associated with the cultivation practices of each; for more detail see Technical Box 3.1.17.

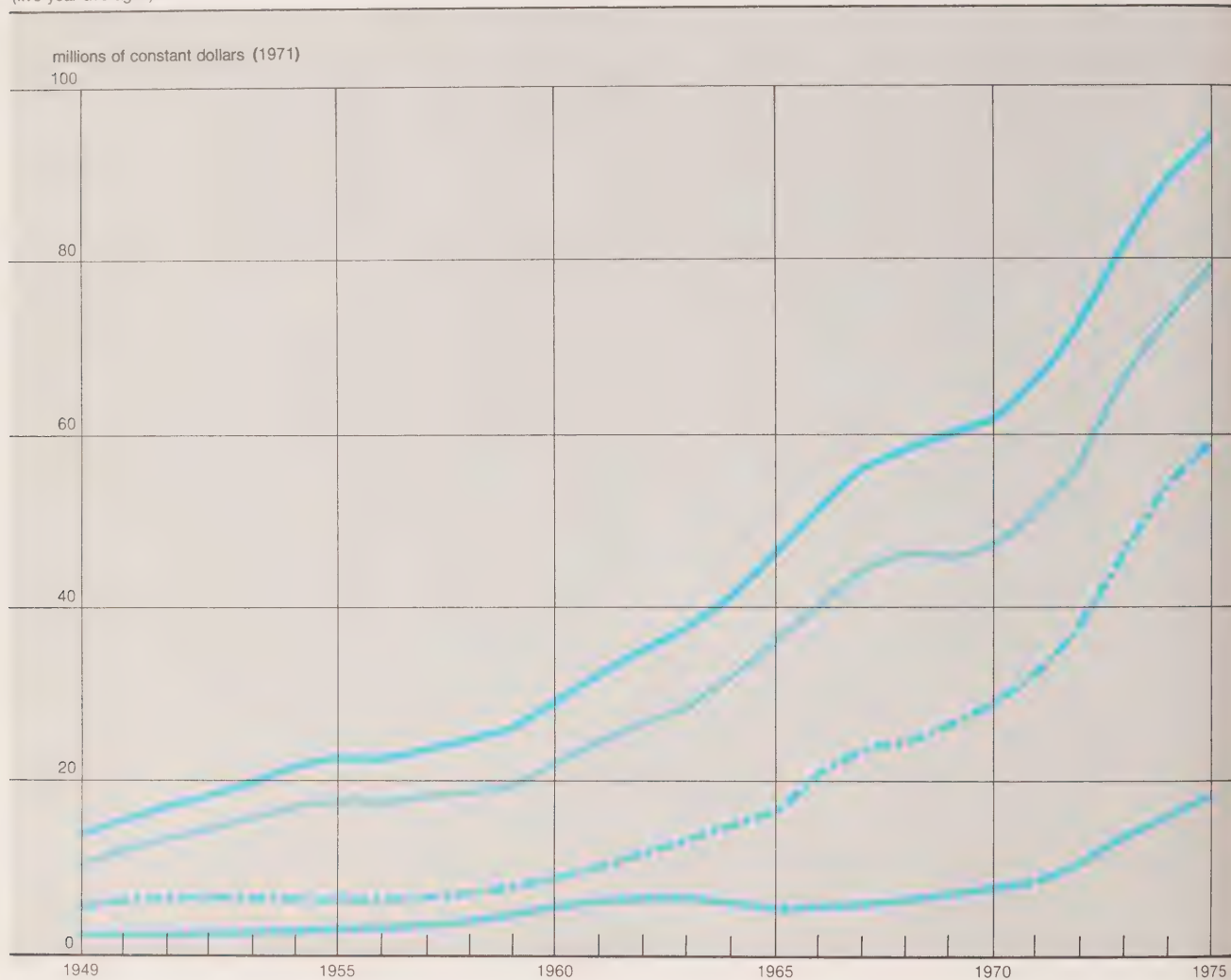
Chart 3.1.14
Nutrient Content of Fertilizers Sold, 1944 to 1975
(five year averages)



Source:
Statistics Canada, *Fertilizer Trade*, Catalogue 46-207, various issues.

..... Nitrogen (N)
———— Phosphoric acid (P_2O_5)
- . - . Potassium (K_2O)

Chart 3.1.15
Sales of Pest Control Products, 1949 to 1975¹
 (five year averages)



¹ Data on sales of pest control products have not been collected by Statistics Canada since 1977.

Sources:

Statistics Canada, *Sales of Pest Control Products by Canadian Registrants*, Catalogue 46-212, various issues.
 Statistics Canada, *Industry Price Indexes*, Catalogue 62-011.

- Total all pesticides
- Total agricultural pesticides
- - - Agricultural herbicides
- . - . Agricultural insecticides

Table 3.1.16
Agricultural Land Use¹ by Ecozone, 1981

Ecozone	Area of Ecozone	Farmland Area	Farmland as a Percentage Total Ecozone Area	Number of Farms	Average Farm Size	Cropland Area	Improved Pasture	Woodland Area	Other Land ²
	thousands of hectares	hectares	percent	number		hectares			
Atlantic Maritime	18 881	1 609 427	8.5	16 771	96	583 127	175 007	651 895	199 398
Prince Edward Island	566	283 024	50.0	3 154	90	158 280	36 228	65 436	23 079
Nova Scotia	5 549	466 023	8.4	5 045	92	112 782	46 106	240 842	66 293
New Brunswick	7 295	436 502	6.0	4 060	108	130 022	41 479	199 688	65 313
Québec	5 471	423 879	7.7	4 512	94	182 044	51 194	145 930	44 711
Mixed-Wood Plain	19 496	7 888 125	40.5	113 373	70	4 721 579	861 116	1 194 725	1 110 705
Québec	5 694	2 560 053	45.0	36 713	70	1 293 910	289 532	658 168	318 443
Ontario	13 802	5 328 072	38.6	76 660	70	3 427 670	571 584	536 557	792 261
Boreal Shield	171 733	1 597 440	0.9	13 700	117	515 230	196 681	483 737	401 792
Newfoundland	12 299	33 454	0.3	679	49	4 744	4 148	5 770	18 792
New Brunswick	49	1 386	2.8	3	462	505	0	845	361
Québec	69 371	795 238	1.1	6 919	115	280 084	102 833	265 402	146 918
Ontario	65 218	711 165	1.1	5 788	123	205 057	85 425	205 719	214 963
Manitoba	24 846	56 197	0.2	311	182	24 841	4 275	6 001	21 080
Prairie	49 114	42 626 476	86.8	116 009	367	19 934 083	2 123 627	399 866	20 168 900
Manitoba	7 052	5 995 255	85.0	22 436	267	3 731 779	258 043	129 412	1 876 021
Saskatchewan	25 365	22 699 936	89.5	56 605	401	10 105 171	820 220	133 658	11 640 887
Alberta	16 698	13 931 285	83.4	36 968	377	6 097 132	1 045 364	136 796	6 651 992
Boreal Plain	85 820	10 585 123	12.3	40 141	264	4 885 748	824 002	657 928	4 217 445
Manitoba	12 969	1 564 476	12.1	6 697	234	663 750	90 189	112 772	697 765
Saskatchewan	25 877	3 247 148	12.5	10 711	303	1 635 692	155 144	147 995	1 308 317
Alberta	37 585	5 079 552	13.5	20 927	607	2 330 671	530 788	352 216	1 865 877
British Columbia	9 390	693 947	7.4	1 806	384	255 635	47 880	44 946	345 486
Montane Cordillera	46 330	1 384 998	3.0	9 866	140	245 962	191 829	139 905	807 302
Alberta	4 386	97 677	2.2	161	607	13 438	5 290	3 660	75 289
British Columbia	41 945	1 287 321	3.1	9 705	133	232 524	186 539	136 246	732 013
Pacific Maritime	19 704	170 244	0.9	8 436	20	75 176	29 668	18 789	46 611
British Columbia	19 704	170 244	0.9	8 436	20	75 176	29 668	18 789	46 611
Boreal Cordillera	42 577	27 083	0.1	65	417	4 906	2 796	4 049	15 332
British Columbia	20 754	27 083	0.1	65	417	4 906	2 796	4 049	15 332
Yukon	21 824	..	..	..	..	..	..	..	..
Canada	997 061	65 888 916	6.6	318 361	207	30 965 812	4 404 726	3 550 894	26 967 482

For definitions of agricultural land uses, see the note in Table 3.1.5
Other land refers to summerfallow, native pasture, rangeland, cutover, and sloughs.

Source: Statistics Canada, 1981 Census of Agriculture, special tabulation by the Office of the Senior Advisor on Integration.

Notes:

The Yukon and Northwest Territories have been excluded from the 1981 Census of Agriculture because of the small number of farms (less than twenty).

The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield has been allocated to the Boreal Plain. These minor adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Technical Box 3.1.17

Cropping Practices: An Indicator of Environmental Stress

Agricultural statistics which describe cropping intensity and changes in cropping patterns over time, can be used as indicators of environmental stress. In this chapter, crop data have been organized into the following cropping practices: (i) wide-row cropping, (ii) close-row cropping, (iii) summer fallowing, and (iv) forage cropping¹. To focus more sharply on intensity of cropping practices, a further distinction is made by identifying the farms on which over eighty percent of cropland is under a particular wide-row or close-row cropping practice. These are referred to as monoculture farms in this publication². From an ecological perspective, monoculture crop systems are inherently unstable being susceptible to widespread outbreaks of insects, weeds, disease, and micro-nutrient imbalances. Increased crop yields have been achieved and maintained largely by monoculture practices and the increasing application of fertilizers. (Table 3.1.14) Monoculture is therefore highly productive, however, pesticides are needed to stabilize pests which propagate readily in monoculture systems (Table 3.1.15).

(i) Wide-row cropping practices are associated with high applications of fertilizers and pesticides per hectare (see table below), and the relatively high risk of soil erosion. There is evidence that some wide-row cropping practices hasten natural organic matter decomposition which in turn affects soil stability and fertility. Soil compaction is also a concern in wide-row cropping as a result of the use of heavy machinery. The land devoted to wide-row crop cultivation was 1.5 million hectares in 1971 and 2.4 million hectares in 1981, a growth of forty-five percent over the decade. Eighty percent of the land in this particular use is found in the Mixed-Wood Plain Ecozone and is further concentrated in southern Ontario (See Map 3.1.19). The significance of farms classified as wide-row monoculture is evident as they account for four times the expenditure on fertilizers and chemicals per hectare when compared to the Canadian farm average (see table below).

(ii) Close-row cropping practices provide a vegetation cover similar to natural grasslands during the growing season and thus, provides better protection from soil erosion than open plowed land and land in wide-row crops. On the other hand, the scale of operations in this practice, particularly in the Prairie Ecozone, the introduction of high yielding crops and the increase in the use of fertilizers are some of the factors that suggest an intensification of environmental stress generally associated with single crop systems. The prevalence of close-row monoculture is evident as over sixty percent of the cropland in Canada was under this practice in 1981, while the figure approached eighty percent in the Prairie Ecozone (See Table 3.1.18).

(iii) Summer fallowing practice is linked to close-row cropping mainly in the Prairie region. The purpose of summer fallowing is to conserve soil moisture and release soil nutrients. Environmental concerns associated with summer fallow are wind and water erosion and salinization (i.e. the tendency for excess soil water to cause the migration of sub-strata salts to downslope evaporation areas).

(iv) Forage cropping practice is associated with livestock production and pasturage. Soil erosion is kept to a minimum by grass cover. Furthermore, a forage-based rotational cropping system (which includes legumes) is a natural means of restoring nitrogen to soils.

Many of the tables which follow in this chapter present cropping practice statistics by Ecozone and Major Drainage Area. More detailed information for all Drainage Basins have been compiled for the variables appearing here. Some of this information appears in the Appendix or is available upon request.

¹ Crops reported in the Agricultural Census were grouped into the following categories:

Wide-row crops — corn for grain, corn for silage, soybeans, sunflowers, dry field peas, dry field beans, potatoes, sugar beets, tobacco, vegetables.

Close-row crops — oats for grain, barley, mixed grain, buckwheat, flaxseed, rapeseed, mustard, fodder oats, wheat, rye.

Fodder crops — alfalfa, improved pasture, other fodder crops.

² Methodology based on D. Trant, "Cropping Practice Pilot Study: A Methodology to Enhance Agricultural Statistics for Environmental Assessment," Unpublished Working Paper, September 1983.

Technical Box 3.1.17

Profile of Monoculture¹ Farms, 1971 and 1981

	Average Farm Size		Distribution of Farms		Distribution of Cropland		Distribution of Fertilizer Expenses		Distribution of Chemical Expenses		Fertilizer Expenses per Hectare of Cropland		Chemical Expenses per Hectare of Cropland	
	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981	1971	1981
	hectares		percent				dollars ² per hectare							
Wide-Row Monoculture	56	69	4	5	2	3	12	12	19	12	39	40	15	15
Close-Row Monoculture	288	339	36	34	61	62	43	49	27	49	2	7	1	3
Forage Monoculture	128	130	21	23	7	7	5	2	4	2	6	8	1	1
Other ³	140	153	39	38	30	28	40	37	50	37	8	15	3	5
Canada Average or Total	188	207	100	100	100	100	100	100	100	100	5	10	2	3

¹ Monoculture is defined as the planting of one crop type on a continuous year-to-year basis. Monoculture farms in the above table are farms where 80% or more of cropland is under one crop type.

² Expenses are in constant dollars (1971) and were converted using farm input price indices for fertilizer and farm chemicals.

³ Includes all other farms not defined as monocultures.

Source:

Statistics Canada, Census of Agriculture 1981, Special Tabulation by the Office of Senior Adviser on Integration.
Statistics Canada, *Farm Input Price Index*, Catalogue 62-004, Various issues.

Table 3.1.18
Cropping Practices by Ecozone, 1981

Ecozone	Cultivated ¹ Area		Wide-Row ²		Close-Row ³		Forage ⁴		Summerfallow ⁵		Other Crops ⁶	
	hectares	percent	hectares	percent	hectares	percent	hectares	percent	hectares	percent	hectares	percent
Atlantic Maritime	777 838	76 199	9.8	171 284	22.0	439 968	56.6	19 703	2.5	70 684	9.1	
Prince Edward Island	199 683	32 100	16.1	73 994	37.1	80 935	40.5	5 175	2.6	7 479	3.7	
Nova Scotia	161 915	10 097	6.2	19 276	11.9	111 641	69.0	3 027	1.9	17 874	11.0	
New Brunswick	176 655	27 633	15.6	27 352	15.5	106 506	60.3	5 154	2.9	10 010	5.7	
Quebec	239 585	6 369	2.7	50 662	21.1	140 886	58.8	6 347	2.6	35 321	14.7	
Mixed-Wood Plain	5 674 074	1 897 760	33.4	1 150 047	20.3	1 791 028	31.6	91 378	1.6	743 861	13.1	
Quebec	1 618 258	292 383	18.1	304 413	18.8	851 703	52.6	34 816	2.2	134 943	8.3	
Ontario	4 055 816	1 605 377	39.6	845 634	20.8	939 325	23.2	56 562	1.4	608 918	15.0	
Boreal Shield	734 402	19 356	2.6	127 816	17.4	491 630	66.9	22 490	3.1	73 111	10.0	
Newfoundland	9 249	962	10.4	296	3.2	7 179	77.6	358	3.9	454	4.9	
New Brunswick	513	132	25.6	327	63.7	8	1.6	8	1.6	38	7.5	
Quebec	394 831	10 345	2.6	61 434	15.6	287 136	72.7	11 914	3.0	24 002	6.1	
Ontario	297 229	7 411	2.5	52 494	17.7	190 371	64.0	6 747	2.3	40 206	13.5	
Manitoba	32 580	506	1.6	13 265	40.7	6 936	21.3	3 464	10.6	8 409	25.8	
Prairie	30 515 217	354 084	1.2	17 790 486	58.3	2 660 062	8.7	8 457 508	27.7	1 253 077	4.1	
Manitoba	4 456 532	286 781	6.4	3 055 062	68.6	352 287	7.9	466 710	10.5	295 692	6.6	
Saskatchewan	17 131 742	22 080	0.1	9 479 067	55.3	985 633	5.8	6 206 351	36.2	438 611	2.6	
Alberta	8 926 943	45 224	0.5	5 256 357	58.9	1 322 142	14.8	1 784 447	20.0	518 773	5.8	
Boreal Plain	6 805 287	22 808	0.3	3 668 734	53.9	1 478 304	21.7	1 095 537	16.1	539 904	7.9	
Manitoba	882 103	13 405	1.5	462 791	52.5	155 039	17.6	128 164	14.5	122 704	13.9	
Saskatchewan	2 288 949	7 809	0.3	1 419 110	62.0	226 168	9.9	498 113	21.8	137 749	6.0	
Alberta	3 281 281	1 488	--	1 612 422	49.1	998 692	30.4	419 822	12.8	248 857	7.6	
British Columbia	352 953	106	--	174 411	49.4	98 405	27.9	49 438	14.0	30 593	8.7	
Montane Cordillera	448 870	5 595	1.2	40 145	8.9	287 362	64.0	11 079	2.5	104 689	23.3	
Alberta	19 927	0	0.0	5 846	29.3	7 549	37.9	1 199	6.0	5 333	26.8	
British Columbia	428 943	5 595	1.3	34 299	8.0	279 813	65.2	9 880	2.3	99 356	23.2	
Pacific Maritime	108 140	17 715	16.4	7 226	6.7	71 702	66.3	3 296	3.0	8 201	7.6	
British Columbia	108 140	17 715	16.4	7 226	6.7	71 702	66.3	3 296	3.0	8 201	7.6	
Boreal Cordillera	8 615	3	--	1 566	18.2	5 734	66.6	913	10.6	399	4.6	
British Columbia	8 615	3	--	1 566	18.2	5 734	66.6	913	10.6	399	4.6	
Canada	45 072 443	2 393 520	5.3	22 957 305	50.9	7 225 790	16.0	9 701 904	21.5	2 793 925	6.2	

Footnotes:

¹ Cultivated area refers to land that is under crops, is improved pasture, or is fallow land.

² Wide-row crop areas refer to areas planted in corn, soybeans, tobacco, sunflowers, dry field peas, field beans, potatoes, and all vegetables.

³ Close-row crop areas refer to areas planted in oats, barley, mixed-grain, all wheat, flaxseed, rapeseed, mustardseed, and rye.

⁴ Forage crop areas refer to areas planted in alfalfa, tame hay other fodder crops and improved pasture. For more detail see Technical Box 3.1.17.

⁵ Summerfallow refers to land upon which a crop is temporarily not being grown in order to build up soil moisture.

⁶ Other crop areas refers to tree fruit areas, berry and grape areas, greenhouses, nurseries, mushroom farms, and other minor crop areas.

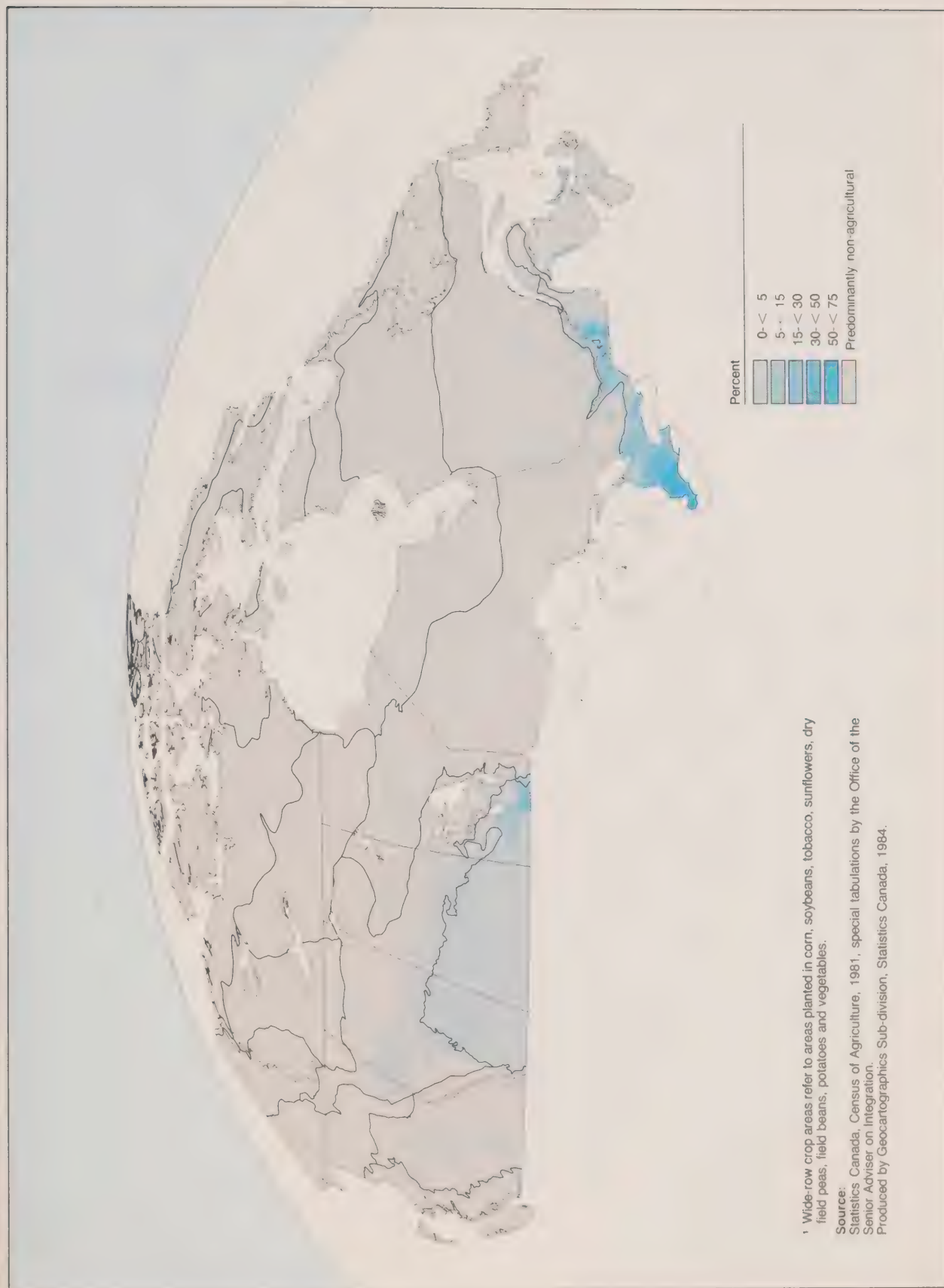
Source:

Statistics Canada, Census of Agriculture 1981, special tabulation by the Office of the Senior Advisor on Integration.

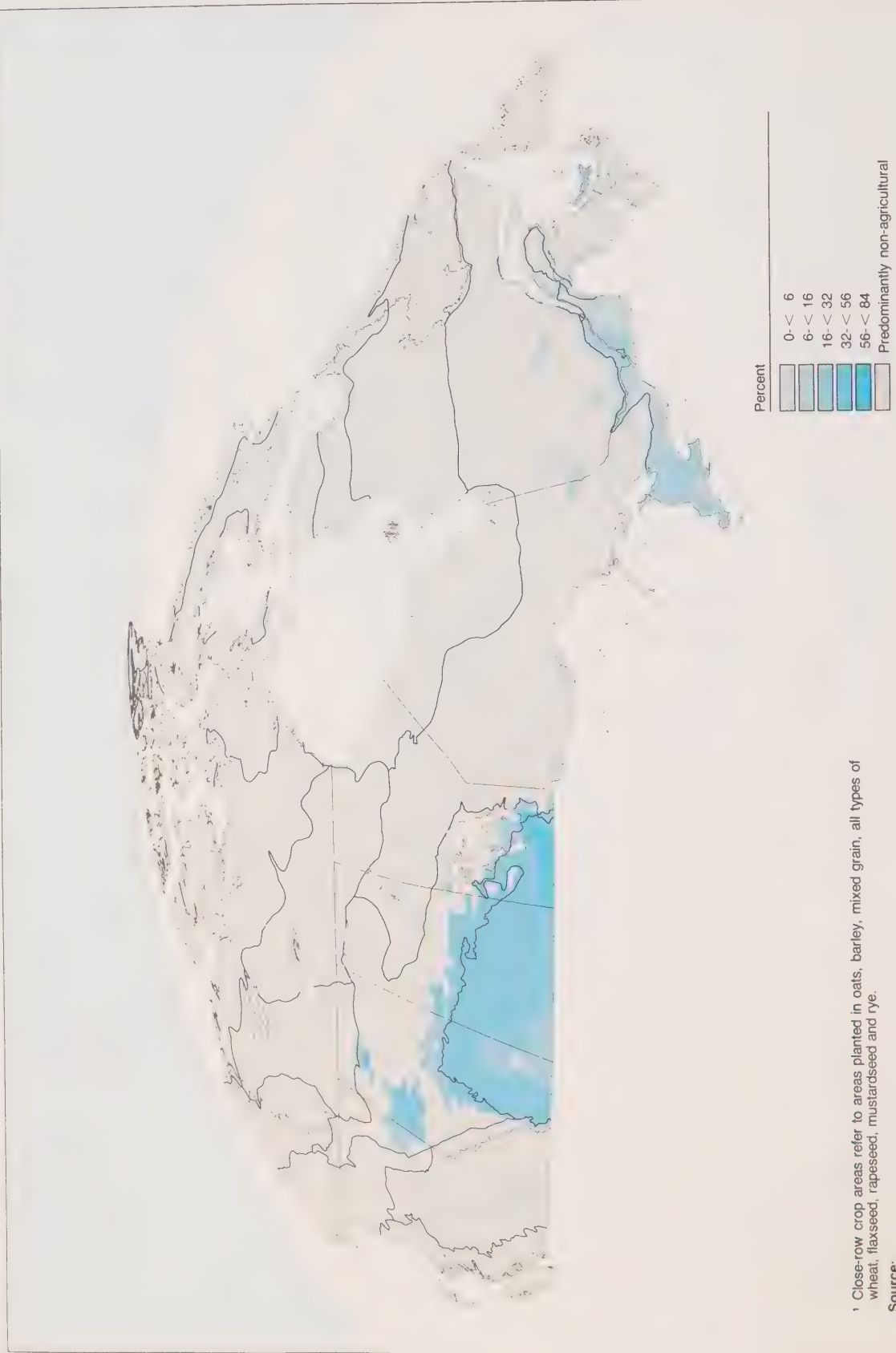
Notes:

The Yukon and Northwest Territories have been excluded from the 1981 Census of Agriculture because of the small number of farms (less than twenty).

The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Shield and the Taiga Plain have been allocated to the Boreal Plain. These adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Wide-Row¹ Cropland as a Percentage of Total Farmland, by Census Division, 1981

Map 3.1.20
Close-Row¹ Cropland as a Percentage of Total Farmland, by Census Division, 1981



¹ Close-row crop areas refer to areas planted in oats, barley, mixed grain, all types of wheat, flaxseed, rapeseed, mustardseed and rye.

Source:
Statistics Canada, Census of Agriculture, 1981, special tabulations by the Office of the Senior Adviser on Integration.
Produced by Geocartographics Sub-division, Statistics Canada, 1984.

Table 3.1.21
Agricultural Land Use¹ by Major Drainage Area, 1981

Major Drainage Area	Area of Major Drainage Area	Farmland Area	Farmland Area as a Percentage of Major Drainage Area	Number of Farms	Average Farm Size	Cropland Area	Improved Pasture Area	Woodland Area	Other Land ² Area
	thousands of hectares	hectares	percent	number			hectares		
Atlantic Ocean Basin	155 994	10 764 928	6.9	141 811	76	5 709 582	1 193 291	2 257 356	1 604 698
Atlantic Ocean Coastal	34 026	93 475	0.3	1 454	64	13 626	8 564	53 334	17 952
Gulf of St. Lawrence Coastal	42 963	878 392	2.0	8 907	99	360 269	105 355	308 425	104 343
Bay of Fundy Coastal and Saint John River	6 259	704 841	11.3	6 676	106	197 960	63 824	344 318	98 740
St. Lawrence River	21 059	2 977 492	14.1	41 880	71	1 493 521	354 468	725 413	404 091
Ottawa River	14 669	1 377 391	9.4	14 043	98	580 723	194 888	328 426	273 354
Lake Ontario	2 970	1 162 531	39.1	18 430	63	621 685	134 873	139 648	266 324
Lake Erie and Lake St. Clair Shore	2 355	1 887 022	80.1	29 777	63	1 507 481	106 580	124 002	148 958
Lake Huron Shore	9 252	1 647 291	17.8	20 229	81	919 501	221 036	224 503	282 251
Lake Superior Shore	10 180	36 493	0.4	415	88	14 817	3 703	9 287	8 686
Hudson Bay and Ungava Bay Basin	352 436	47 368 476	13.4	141 087	336	22 470 605	2 562 264	852 740	21 482 868
Hudson Bay and Ungava Bay Coastal	252 607	1 057 724	0.4	3 972	266	403 993	93 334	96 901	463 496
Lake Winnipeg Shore	33 698	5 860 345	17.4	24 090	243	3 302 521	274 122	263 620	2 020 082
Assiniboine River	16 185	14 543 592	89.9	41 592	350	7 100 976	542 001	134 151	6 766 464
Saskatchewan River	40 910	25 906 816	63.3	71 433	363	11 663 115	1 652 808	358 067	12 232 826
Arctic Ocean Basin	384 989	4 260 714	1.1	15 110	282	1 976 814	344 158	284 439	1 655 303
Mackenzie River	179 537	4 260 714	2.4	15 110	282	1 976 814	344 158	284 439	1 655 303
Pacific Ocean Basin	101 028	1 454 105	1.4	18 129	80	307 236	215 967	154 878	776 023
Columbia River	10 394	273 921	2.6	5 297	52	67 716	38 952	30 392	136 861
Fraser River	23 514	1 034 927	4.4	10 093	103	203 493	155 804	103 164	572 467
Pacific Ocean, North Coastal	25 812	87 091	0.4	469	186	18 000	12 474	10 313	46 305
Pacific Ocean, South Coastal	7 829	58 166	0.7	2 270	26	18 027	8 738	11 009	20 391
Gulf of Mexico Basin	2 614	2 040 692	78.1	2 224	918	501 575	89 045	1 481	1 448 591
Missouri River	2 614	2 040 692	78.1	2 224	918	501 575	89 045	1 481	1 448 591
Canada	997 061	65 888 916	6.6	318 361	207	30 965 812	4 404 726	3 550 894	26 967 482

¹ For definitions of agricultural land uses, see the note in Table 3.1.5.
² Other land refers to summerfallow, native pasture, rangeland, cutover and sloughs.

Source:
Statistics Canada, Census of Agriculture 1981, special tabulation by the Office of the Senior Advisor on Integration.
Note:
Individual items may not add to totals due to rounding.

Table 3.1.22
Cropping Practices by Major Drainage Area, 1981

Major Drainage Area	Cultivated ¹ Area		Wide-Row ²		Close-Row ³		Forage ⁴		Summerfallow ⁵		Other Crops ⁶	
	hectares	percent	hectares	percent	hectares	percent	hectares	percent	hectares	percent	hectares	percent
Atlantic Ocean Basin	7 028 432	1 991 876	28.3	1 421 275	20.2	2 624 542	37.3	125 558	1.8	865 181	12.3	
Atlantic Ocean Coastal	22 694	1 062	4.7	1 122	4.9	18 316	80.7	504	2.2	1 690	7.4	
Gulf of St. Lawrence Coastal	477 047	38 712	8.1	126 177	26.4	260 791	54.7	11 423	2.4	39 944	8.4	
Bay of Fundy Coastal and Saint John River	269 460	34 845	12.9	39 279	14.6	166 103	61.6	7 676	2.8	21 557	8.0	
St. Lawrence River	1 888 109	316 346	16.8	351 728	18.6	1 014 684	53.7	40 120	2.1	165 231	8.8	
Ottawa River	790 768	108 783	13.8	131 159	16.6	425 325	53.8	15 157	1.9	110 344	14.0	
Lake Ontario Shore	777 005	205 009	26.4	155 073	20.0	219 371	28.2	20 447	2.6	177 105	22.8	
Lake Erie and Lake St. Clair Shore	1 628 875	942 043	57.8	351 969	21.6	164 075	10.1	14 814	0.9	155 974	9.6	
Lake Huron Shore	1 155 601	344 745	29.8	261 607	22.6	343 954	29.8	15 064	1.3	190 231	16.5	
Lake Superior Shore	18 873	331	1.8	3 161	16.7	11 923	63.2	353	1.9	3 105	16.5	
Hudson Bay and Ungava Bay Basin	33 832 403	376 924	1.1	19 585 667	57.9	3 461 114	10.2	8 799 533	26.0	1 609 165	4.8	
Hudson Bay and Ungava Bay Coastal	571 308	1 008	0.2	253 400	44.4	182 524	31.9	73 981	12.9	60 395	10.6	
Lake Winnipeg Shore	4 039 984	241 173	6.0	2 568 587	63.6	420 556	10.4	463 341	11.5	346 327	8.6	
Assiniboine River	11 365 946	71 534	0.6	6 572 141	57.8	668 182	5.9	3 722 969	32.8	331 120	2.9	
Saskatchewan River	17 855 165	63 209	0.4	10 191 539	57.1	2 189 852	12.3	4 539 242	25.4	871 323	4.9	
Arctic Ocean Basin	2 723 658	1 270	--	1 449 928	53.2	700 200	25.7	402 686	14.8	169 574	6.2	
Mackenzie River	27 236 658	1 270	--	1 449 928	53.2	700 200	25.7	402 686	14.8	169 574	6.2	
Pacific Ocean Basin	536 092	23 311	4.3	41 392	7.7	338 292	63.1	12 889	2.4	120 208	22.4	
Columbia River	108 570	2 519	2.3	11 307	10.4	50 069	46.1	1 902	1.8	42 773	39.4	
Fraser River	368 869	19 070	5.2	26 174	7.1	253 133	68.6	9 572	2.6	60 920	16.5	
Pacific Ocean, North Coastal	31 173	155	0.5	2 298	7.4	25 796	82.8	699	2.2	2 224	7.1	
Pacific Ocean, South Coastal	27 481	1 567	5.7	1 613	5.9	9 294	33.8	716	2.6	14 291	52.0	
Gulf of Mexico Basin	951 858	139	--	459 044	48.2	101 640	10.7	361 238	38.0	29 797	3.1	
Missouri River	951 858	139	--	459 044	48.2	101 640	10.7	361 238	38.0	29 797	3.1	
Canada	45 072 443	2 393 520	5.3	22 957 305	50.9	7 225 790	16.0	9 701 904	21.5	2 793 925	6.2	

¹ Cultivated land refers to land that is under crops, in improved pasture or in fallow.

² Wide-row crop areas refer to areas planted in corn, soybeans, tobacco sunflowers, dry field peas, field beans, potatoes, and all vegetables.

³ Close-row crop areas refer to areas planted in oats, barley, mixed-grain, all wheat, flaxseed, rapeseed, mustardseed, and rye.

⁴ Forage crop areas refer to areas planted in alfalfa, tame hay other fodder crops and improved pasture. For more details see Technical Box 3.1.17.

⁵ Summerfallow area refers to land upon which a crop is temporarily not being grown in order to build up soil moisture.

⁶ Other crop areas refers to tree fruit areas, berry and grape areas, greenhouses, nurseries, mushroom farms, and other minor crop areas.

Source:
Statistics Canada, Census of Agriculture 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:
Individual items may not add to totals due to rounding.

Table 3.1.23
Cropping Practices by Ecozone, 1971, 1976 and 1981

Ecozone	Wide-Row ¹ Crop Area				Close-Row ² Crop Area			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares			percent	hectares			percent
Atlantic Maritime	65 913	78 381	76 198	15.6	176 053	174 597	171 284	-2.7
Prince Edward Island	23 272	30 362	32 100	37.9	65 847	70 910	73 994	12.4
Nova Scotia	9 073	11 054	10 096	11.3	18 535	16 770	19 276	4.0
New Brunswick	27 838	28 633	27 633	-0.7	32 778	31 526	27 352	-16.6
Québec	5 730	8 332	6 369	11.1	58 893	55 391	50 662	-14.0
Mixed-Wood Plain	1 207 570	1 522 527	1 897 759	57.2	1 231 154	1 196 063	1 150 048	-6.6
Québec	156 066	206 062	292 383	87.4	310 310	290 125	304 413	-1.9
Ontario	1 051 504	1 316 465	1 605 376	52.7	920 844	905 938	845 634	-8.2

Table 3.1.23
Cropping Practices by Ecozone, 1971, 1976 and 1981 (continued)

Ecozone	Wide-Row ¹ Crop Area				Close-Row ² Crop Area			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares			percent	hectares			percent
Boreal Shield	12 657	19 300	19 361	53.0	126 396	139 791	127 815	1.1
Newfoundland	900	1 053	967	7.4	104	268	296	184.8
New Brunswick	7	11	132	1 785.7	125	94	327	161.6
Québec	6 460	11 062	10 345	60.1	76 566	81 390	61 434	-19.8
Ontario	5 281	6 980	7 411	40.3	42 053	48 723	52 493	24.8
Manitoba	9	194	506	5 520.6	7 548	9 316	13 265	75.7
Prairie	197 122	137 872	354 079	79.6	16 343 884	15 911 500	17 790 487	8.9
Manitoba	118 923	85 152	286 776	141.1	2 701 536	2 781 234	3 055 062	13.0
Saskatchewan	33 181	8 205	22 079	-33.5	9 161 990	8 560 057	9 479 067	3.5
Alberta	45 018	44 515	45 224	0.5	4 480 358	4 570 209	5 256 357	17.3
Boreal Plain	5 334	10 002	22 809	327.6	3 094 434	3 034 916	3 668 734	18.6
Manitoba	1 863	2 786	13 405	619.5	402 323	374 758	462 791	15.0
Saskatchewan	1 763	4 340	7 809	342.9	1 136 642	1 119 946	1 419 110	24.9
Alberta	1 552	2 766	1 489	-4.1	1 405 321	1 396 012	1 612 422	14.7
British Columbia	156	110	106	-32.1	150 148	144 200	174 411	16.1
Montane Cordillera	5 033	5 117	5 595	11.2	32 632	35 162	40 145	23.0
Alberta	0	0	0	0.0	4 690	5 303	5 846	24.6
British Columbia	5 033	5 117	5 595	11.2	27 942	29 859	34 299	22.8
Pacific Maritime	12 113	15 898	17 715	46.3	6 456	6 482	7 226	11.9
British Columbia	12 113	15 898	17 715	46.3	6 456	6 482	7 226	11.9
Boreal Cordillera	18	0	3	-83.3	3 173	1 459	1 566	-50.6
British Columbia	18	0	3	-83.3	3 173	1 459	1 566	-50.6
Canada	1 505 760	1 789 097	2 393 510	59.0	21 014 180	20 499 972	22 957 304	9.2
Ecozone	Forage ³ Crop Area				Summerfallow ⁴ Area			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares			percent	hectares			percent
Atlantic Maritime	486 480	471 889	439 968	-9.6	13 305	8 652	19 703	48.1
Prince Edward Island	90 066	87 978	80 935	-10.1	3 476	2 344	5 175	48.9
Nova Scotia	102 073	110 466	111 641	9.4	3 717	2 909	3 027	-18.6
New Brunswick	107 998	108 254	106 506	-1.4	2 538	1 867	5 154	103.1
Québec	186 343	165 191	140 886	-24.4	3 574	1 532	6 347	77.6
Mixed-Wood Plain	2 413 862	2 135 957	1 791 028	-25.8	113 308	86 648	91 378	-19.4
Québec	1 159 336	1 005 740	851 703	-26.5	22 307	15 118	34 816	56.1
Ontario	1 254 526	1 130 217	939 325	-25.1	91 001	71 530	56 562	-37.8
Boreal Shield	535 425	527 877	491 630	-8.2	14 931	10 391	22 490	50.6
Newfoundland	5 275	8 493	7 179	36.1	202	175	358	77.1
New Brunswick	400	151	8	-98.0	2	0	8	400.0
Québec	335 567	311 791	287 136	-14.4	7 170	3 791	11 914	66.2
Ontario	184 336	199 572	190 371	3.3	5 280	4 005	6 747	27.8
Manitoba	9 847	7 870	6 936	-29.6	2 277	2 420	3 464	52.1
Prairie	2 246 968	2 473 703	2 660 062	18.4	9 258 057	9 415 817	8 457 508	-8.6
Manitoba	325 448	346 389	352 287	8.2	904 762	765 190	466 710	-48.4
Saskatchewan	865 047	943 900	985 633	13.9	6 045 344	6 532 727	6 206 351	2.7
Alberta	1 056 473	1 183 414	1 322 142	25.1	2 307 951	2 117 900	1 784 447	-22.7
Boreal Plain	1 184 063	1 433 477	1 478 304	24.9	1 413 053	1 389 645	1 095 537	-22.5
Manitoba	141 514	148 533	155 039	9.6	167 481	166 488	128 164	-23.5
Saskatchewan	223 255	274 219	226 168	1.3	656 179	653 926	498 113	-24.1
Alberta	758 414	935 299	998 692	31.7	527 260	509 677	419 822	-20.4
British Columbia	60 880	75 426	98 405	61.6	62 133	59 554	49 438	-20.4
Montane Cordillera	184 580	200 397	287 362	55.7	6 839	7 247	11 079	62.0
Alberta	21 178	10 099	7 550	-64.3	1 114	638	1 199	7.6
British Columbia	163 402	190 298	279 812	71.2	5 725	6 609	9 880	72.6
Pacific Maritime	68 380	67 660	71 702	4.9	1 502	1 181	3 296	119.5
British Columbia	68 380	67 660	71 702	4.9	1 502	1 181	3 296	119.5

Table 3.1.23
Cropping Practices by Ecozone, 1971, 1976 and 1981 (concluded)

Ecozone	Forage ³ Crop Area				Summerfallow ⁴ Area			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares	hectares	hectares	percent	hectares	hectares	hectares	percent
Boreal Cordillera	5 199	3 484	5 734	10.3	577	297	913	58.3
British Columbia	5 199	3 484	5 734	10.3	577	297	913	58.3
Canada	7 124 957	7 314 444	7 225 790	1.4	10 821 572	10 919 878	9 701 906	-10.3

¹ Wide-row crop areas refers to areas planted in corn, soybeans, sunflowers, Dry field peas, field beans, potatoes, and all vegetables.

² Close-row crop areas refers to areas planted in oats, barley, mixed grain, all wheat, flaxseed, rapeseed, mustard seed, and rye.

³ Forage crop areas refers to alfalfa, tame hay, other fodder crops, and improved pasture. For more detail see Technical Box 3.1.17.

⁴ Summerfallow area refers to land upon which a crop is temporarily not being grown in order to build up soil moisture.

Source:

Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Notes:

The Yukon and Northwest Territories have been excluded from the 1981 Census of Agriculture because of the small numbers of farms (less than twenty). The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield have been allocated to the Boreal Plain. These adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Table 3.1.24
Monoculture¹ Farms by Ecozone, 1971, 1976 and 1981

Ecozone	Wide-Row Farms				Close-Row Farms			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number	number	number	percent	number	number	number	percent
Atlantic Maritime	716	591	542	-24.3	1 652	953	886	-46.4
Prince Edward Island	125	81	93	-25.6	402	261	300	-25.4
Nova Scotia	122	109	116	-4.9	266	206	136	-48.9
New Brunswick	413	311	229	-44.6	419	249	151	-64.0
Québec	56	90	104	85.7	565	237	299	-47.1
Mixed-Wood Plain	11 846	11 252	14 650	23.7	6 867	5 480	5 245	-23.6
Québec	1 700	1 628	2 470	45.3	2 689	1 826	2 093	-22.1
Ontario	10 146	9 624	12 180	20.1	4 178	3 654	3 152	-24.6
Boreal Shield	317	350	349	10.1	1 332	917	806	-39.5
Newfoundland	119	130	118	-0.8	5	8	5	0.0
New Brunswick	1	0	0	0.0	0	1	0	0.0
Québec	101	104	129	27.7	919	526	470	-49.0
Ontario	97	116	101	4.1	353	335	276	-21.8
Manitoba	0	0	1	0.0	55	48	55	0.0
Prairie	326	278	378	16.0	99 490	87 108	83 154	-16.4
Manitoba	171	129	223	30.4	17 741	15 545	13 026	-26.6
Saskatchewan	44	42	66	50.0	56 732	50 238	48 573	-14.9
Alberta	111	107	89	-19.8	25 017	21 325	21 555	-13.8
Boreal Plain	43	45	73	69.8	21 238	17 405	18 191	-14.4
Manitoba	10	14	24	140.0	3 791	2 645	2 771	-26.9
Saskatchewan	13	5	9	-30.8	8 843	7 188	7 409	-16.2
Alberta	13	21	31	138.5	7 885	7 003	7 418	-5.9
British Columbia	7	5	9	28.6	719	569	593	-17.5
Montane Cordillera	130	149	154	18.5	221	254	250	13.1
Alberta	0	0	0	0.0	15	12	17	13.3
British Columbia	130	149	154	18.5	206	242	233	13.1
Pacific Maritime	306	321	344	12.4	182	146	91	-50.0
British Columbia	306	321	344	12.4	182	146	91	-50.0

Table 3.1.24
Monoculture¹ Farms by Ecozone, 1971, 1976 and 1981 (concluded)

Ecozone	Wide-Row Farms				Close-Row Farms			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number			percent	number			percent
Boreal Cordillera	1	0	0	0.0	14	7	4	-71.4
British Columbia	1	0	0	0.0	14	7	4	-71.4
Canada	13 686	12 986	16 490	20.5	130 996	112 271	108 627	-17.1

¹ Monoculture is defined as the planting of one crop type on a continuous year-to-year basis. Monoculture farms in the above table are farms where eighty percent of cropland is under one crop type. For more detail see the Technical Box 3.1.17.

Source:
 Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:

The data for the Hudson Bay Plain has been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield has been allocated to the Boreal Plain. These minor adjustments were made to conform to confidentiality restrictions.

Table 3.1.25
Monoculture¹ Cropland Area by Ecozone, 1971, 1976 and 1981

Ecozone	Wide-Row				Close-Row			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares			percent	hectares			percent
Atlantic Maritime	20 546	16 315	16 393	-20.2	25 074	20 948	24 508	-2.3
Prince Edward Island	4 039	3 452	4 241	5.0	8 859	9 895	12 680	43.1
Nova Scotia	1 132	1 465	749	-33.8	2 418	2 250	2 199	-9.0
New Brunswick	14 444	10 097	10 227	-29.2	5 985	3 904	2 773	-53.7
Québec	931	1 301	1 175	26.3	7 812	4 898	6 856	-12.2
Mixed-Wood Plain	460 731	509 788	794 769	72.5	121 419	113 036	120 099	-1.0
Québec	53 397	50 415	106 159	98.8	41 398	39 535	51 202	23.7
Ontario	407 333	459 374	688 610	69.0	80 021	73 501	68 896	-13.9
Boreal Shield	2 681	3 178	3 573	33.2	22 830	25 506	25 188	10.3
Newfoundland	362	437	453	25.2	4	42	34	663.8
New Brunswick	6	0	0	-100.0	4	8	0	-100.0
Québec	1 586	2 100	2 365	49.1	14 908	16 005	12 362	-17.1
Ontario	733	641	754	2.8	4 924	5 422	8 464	71.9
Manitoba	0	0	0	0.0	2 993	4 038	4 328	44.6
Prairie	6 895	6 918	22 503	226.4	14 366 802	13 74 4479	15 593 959	8.5
Manitoba	3 588	4 590	19 781	451.3	2 149 148	2 239 606	2 279 254	6.1
Saskatchewan	469	424	707	50.6	8 559 421	7 857 781	8 851 399	3.4
Alberta	2 838	1 904	2 015	-29.0	3 658 233	3 647 091	4 463 607	22.0
Boreal Plain	361	418	596	65.2	2 000 607	1 887 912	2 596 880	29.8
Manitoba	105	88	295	182.4	278 976	229 354	301 944	8.2
Saskatchewan	149	26	38	-74.3	906 018	825 699	1 173 007	29.5
Alberta	92	290	244	166.1	721 597	757 040	1 009 706	39.9
British Columbia	15	15	18	18.4	94 016	75 819	112 223	19.4
Montane Cordillera	842	1 467	1 274	51.4	6 636	5 859	8 519	28.4
Alberta	0	0	0	0.0	1 264	494	2 037	61.1
British Columbia	842	1 467	1 274	51.4	5 372	5 365	6 482	20.7
Pacific Maritime	5 974	7 830	7 154	19.7	1 333	1 594	3 209	140.7
British Columbia	5 974	7 830	7 154	19.7	1 333	1 594	3 209	140.7
Boreal Cordillera	14	0	0	-100.0	2 225	503	353	-84.1
British Columbia	14	0	0	-100.0	2 225	503	353	-84.1
Canada	498 048	545 915	846 261	69.9	16 546 928	15 799 840	18 372 716	11.0

Table 3.1.25

Monoculture¹ Cropland Area by Ecozone, 1971, 1976 and 1981 (concluded)

¹ Monoculture is defined as the planting of one crop type on a continuous year-to-year basis. Monoculture cropland in the above table is cropland on monoculture farms (eighty percent or more of cropland on these farms is continuously under one crop type). For more detail see Technical Box 3.1.17.

Source:

Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Notes:

The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield have been allocated to the Boreal Plain. These minor adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Table 3.1.26

Cropping Practices by Major Drainage Area, 1971, 1976 and 1981

Major Drainage Area	Wide-Row ¹ Crop Area				Close-Row ² Crop Area			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares	hectares	hectares	percent	hectares	hectares	hectares	percent
Atlantic Ocean Basin	1 285 843	1 619 678	1 991 876	54.9	1 511 495	1 481 954	1 421 275	-6.0
Atlantic Ocean Coastal	971	1 179	1 062	9.4	1 048	1 063	1 122	7.1
Gulf of St. Lawrence Coastal	28 950	38 076	38 712	33.7	127 078	129 442	126 177	-0.7
Bay of Fundy Coastal and Saint John River	34 342	36 989	34 845	1.5	45 239	42 552	39 279	-13.2
St. Lawrence River	169 719	227 106	316 345	86.4	362 878	343 505	351 728	-3.1
Ottawa River	75 142	95 042	108 783	44.8	131 495	125 121	131 159	-0.3
Lake Ontario Shore	102 286	146 245	205 009	100.4	180 082	170 236	155 073	-13.9
Lake Erie and Lake St. Clair Shore	694 535	797 581	942 044	35.6	386 408	399 155	351 969	-8.9
Lake Huron Shore	179 469	277 041	344 745	92.1	274 510	267 800	261 607	-4.7
Lake Superior Shore	429	419	331	-22.8	2 757	3 080	3 161	14.7
Hudson Bay and Ungava Bay Basin	199 158	145 572	376 925	89.3	17 792 330	17 315 258	19 585 667	10.1
Hudson Bay and Ungava Bay Coastal	519	1 108	1 008	94.2	229 458	203 153	253 400	10.4
Lake Winnipeg Shore	103 622	77 581	241 173	132.7	2 261 595	2 333 152	2 568 588	13.6
Assiniboine River	36 535	13 866	71 534	95.8	6 293 645	5 882 226	6 572 141	4.4
Saskatchewan River	58 482	53 017	63 210	8.1	9 007 632	8 896 727	10 191 539	13.1
Arctic Ocean Basin	1 558	2 117	1 269	-18.5	1 224 184	1 239 597	1 449 928	18.4
Mackenzie River	1 558	2 117	1 269	-18.5	1 224 184	1 239 597	1 449 928	18.4
Pacific Ocean Basin	17 146	21 015	23 312	36.0	34 356	36 245	41 390	20.5
Columbia River	2 999	2 650	2 519	-16.0	13 043	11 476	11 307	-13.3
Fraser River	12 731	16 779	19 070	49.8	18 251	20 959	26 174	43.4
Pacific Ocean, North Coastal	87	103	155	77.8	1 460	2 296	2 297	57.4
Pacific Ocean, South Coastal	1 329	1 483	1 567	18.0	1 602	1 514	1 612	0.6
Gulf of Mexico Basin	2 055	715	139	-93.2	451 814	426 919	459 044	1.6
Missouri River	2 055	715	139	-93.2	451 814	426 919	459 044	1.6
Canada	1 505 760	1 789 097	2 393 520	59.0	21 014 180	20 499 972	22 957 304	9.2
Major Drainage Area	Forage ³ Crop Area				Summerfallow ⁴			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares	hectares	hectares	percent	hectares	hectares	hectares	percent
Atlantic Ocean Basin	3 337 374	3 027 120	2 624 545	-21.4	137 088	101 408	125 559	-8.4
Atlantic Ocean Coastal	15 425	15 765	18 316	18.7	318	297	507	58.4
Gulf of St. Lawrence Coastal	306 257	287 099	260 791	-14.8	8 681	5 241	11 423	31.6
Bay of Fundy Coastal and Saint John River	173 951	174 931	166 104	-4.5	4 340	2 976	7 676	76.9
St. Lawrence River	1 347 328	1 188 370	1 014 684	-24.7	26 280	17 887	40 120	52.7
Ottawa River	484 008	465 215	425 325	-12.1	10 942	9 957	15 157	38.5
Lake Ontario Shore	256 005	256 172	219 371	-14.3	24 902	23 641	20 447	-17.9
Lake Erie and Lake St. Clair Shore	290 153	229 393	164 076	-43.5	40 166	26 969	14 814	-63.1
Lake Huron Shore	449 944	396 338	343 954	-23.6	20 907	14 149	15 064	-27.9
Lake Superior Shore	14 303	13 837	11 924	-16.6	552	291	353	-36.0

Table 3.1.26
Cropping Practices by Major Drainage Area, 1971, 1976 and 1981 (concluded)

Major Drainage Area	Forage ³ Crop Area				Summerfallow ⁴			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares	hectares	hectares	percent	hectares	hectares	hectares	percent
Hudson Bay and Ungava Bay Basin	2 948 448	3 319 570	3 449 095	17.0	9 864 826	9 975 305	8 799 532	-10.8
Hudson Bay and Ungava Bay Coastal	144 548	191 214	182 525	26.3	95 019	88 771	73 981	-22.1
Lake Winnipeg Shore	417 934	446 192	420 556	0.6	749 366	666 066	463 341	-38.2
Assiniboine River	577 775	625 689	668 992	15.8	3 788 60	4 044 131	3 722 969	-1.7
Saskatchewan River	1 808 191	2 056 475	2 177 022	20.4	5 231 681	5 176 377	4 539 242	-13.2
Arctic Ocean Basin	520 888	629 287	700 199	34.4	471 286	480 387	402 686	-14.6
Mackenzie River	520 888	629 287	700 199	34.4	471 286	480 387	402 686	-14.6
Pacific Ocean Basin	231 538	257 306	350 311	51.3	7 226	7 670	12 890	78.4
Columbia River	40 154	35 982	50 068	24.7	2 229	2 058	1 902	-14.7
Fraser River	159 338	185 681	253 133	58.9	4 301	4 755	9 572	122.6
Pacific Ocean, North Coastal	15 187	16 211	25 019	64.7	320	559	699	118.4
Pacific Ocean, South Coastal	16 859	19 432	22 091	31.0	376	298	716	90.5
Gulf of Mexico Basin	86 709	81 162	101 640	17.2	341 146	355 108	361 238	5.9
Missouri River	86 709	81 162	101 640	17.2	341 146	355 108	361 238	5.9
Canada	7 124 957	7 314 444	7 225 790	1.4	10 821 572	10 919 878	9 701 906	-10.3

¹ Wide-row crop areas refers to areas planted in corn, soybeans, tobacco, sunflowers, dry field peas, field beans, potatoes, vegetables.

² Close-row crop areas refers to areas planted in oats, barley, mixed-grain, all wheat, flaxseed, rapeseed, mustardseed, and rye.

³ Forage crop areas refers to areas planted in alfalfa, tame hay and other fodder crops. For more details see Technical Box 3.1.17.

⁴ Summerfallow area refers to land upon which a crop is temporarily not being grown in order to build up soil moisture.

Source:

Statistics Canada, Census of Agriculture 1971, 1976, and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:

Individual items may not add to totals due to rounding.

Table 3.1.27
Monoculture¹ Farms by Major Drainage Area, 1971, 1976 and 1981

Major Drainage Area	Wide-Row Farms				Close-Row Farms			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number	number	number	percent	number	number	number	percent
Atlantic Ocean Basin	12 862	12 169	15 512	20.6	9 614	7 169	6 787	-29.4
Atlantic Ocean Coastal	109	128	116	6.4	39	29	18	-53.8
Gulf of St. Lawrence Coastal	296	253	248	-16.1	1 067	643	606	-43.2
Bay of Fundy Coastal and Saint John River	418	321	265	-36.5	535	315	248	-53.6
St. Lawrence River	1 769	1 734	2 650	49.8	3 283	2 114	2 403	-26.8
Ottawa River	401	370	463	15.5	798	577	606	-24.1
Lake Ontario Shore	914	1 015	1 297	41.9	1 122	988	831	-25.9
Lake Erie and St. Clair Shore	7 730	6 925	8 622	11.5	1 507	1 452	1 134	-24.8
Lake Huron Shore	1 207	1 402	1 832	51.8	1 244	1 018	925	-25.6
Lake Superior Shore	18	21	19	5.6	19	33	16	-15.8
Hudson Bay and Ungava Bay Basin	369	326	452	22.5	112 381	96 885	93 390	-16.9
Hudson Bay and Ungava Bay Coastal	20	23	27	35.0	1 558	1 017	1 246	-20.0
Lake Winnipeg	154	127	213	38.3	16 500	13 841	12 122	-26.5
Assiniboine River	56	47	71	26.8	41 495	36 222	34 590	-16.6
Saskatchewan River	139	129	141	1.4	52 828	45 805	45 432	-14.0
Arctic Ocean Basin	19	21	27	42.1	6 551	6 074	6 354	-3.0
Mackenzie River	19	21	27	42.1	6 551	6 074	6 354	-3.0

Table 3.1.27
Monoculture¹ Farms by Major Drainage Area, 1971, 1976 and 1981 (concluded)

Major Drainage Area	Wide-Row Farms				Close-Row Farms			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number			percent	number			percent
Pacific Ocean Basin	436	470	498	14.2	388	388	321	-17.3
Columbia River	90	108	95	5.6	104	105	111	6.7
Fraser River	287	283	327	13.9	226	206	157	-30.5
Pacific Ocean, North Coastal	12	15	12	0.0	11	21	12	9.1
Pacific Ocean, South Coastal	47	64	64	36.2	47	56	41	-12.8
Gulf of Mexico Basin	0	0	0	0.0	2 062	1 755	1 775	-13.9
Missouri River	0	0	0	0.0	2 062	1 755	1 775	-13.9
Canada	13 686	12 986	16 490	20.5	130 996	112 271	108 627	-17.1

¹ Monoculture is defined as the planting of one crop type on a continuous year-to-year basis. Monoculture farms in the above table are farms where eighty percent cropland is under one crop type. For more details see Technical Box 3.1.17.

Source:
 Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Table 3.1.28
Monoculture¹ Cropland Area by Major Drainage Area, 1971, 1976 and 1981

Major Drainage Area	Wide-Row				Close-Row			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	hectares			percent	hectares			percent
Atlantic Ocean Basin	483 859	529 215	814 292	68.3	163 673	151 974	162 053	-1.0
Atlantic Ocean Coastal	352	443	380	8.0	163	118	93	-42.9
Gulf of St. Lawrence Coastal	4 735	4 664	5 661	19.6	17 883	17 368	19 711	10.2
Bay of Fundy Coastal and Saint John River	15 094	10 935	10 346	-31.5	7 042	4 166	4 403	-37.5
St. Lawrence River	55 890	53 756	111 585	99.7	50 856	48 909	58 813	15.6
Ottawa River	13 406	12 962	22 322	66.5	11 850	10 667	15 296	29.1
Lake Ontario Shore	23 761	34 788	64 156	170.0	20 761	19 310	15 573	-25.0
Lake Erie and Lake St. Clair Shore	328 517	348 126	492 500	49.9	29 665	30 948	27 334	-7.9
Lake Huron Shore	42 050	63 466	107 269	155.1	25 244	20 257	20 505	-18.8
Lake Superior Shore	54	76	72	33.4	207	231	325	56.6
Hudson Bay and Ungava Bay Basin	7 254	7 134	23 371	222.2	15 280 745	14 526 040	16 802 237	10.0
Hudson Bay and Ungava Bay Coastal	97	66	435	347.9	133 255	90 826	155 367	16.6
Lake Winnipeg	2 525	4 012	16 386	549.0	1 698 353	1 755 638	1 816 948	7.0
Assiniboine River	1 535	836	4 146	170.0	5 811 690	5 302 723	6 013 113	3.5
Saskatchewan River	3 097	2 220	2 404	-22.4	7 637 447	7 376 853	8 816 809	15.4
Arctic Ocean Basin	119	261	171	44.0	684 001	732 840	973 601	42.3
Mackenzie River	119	261	171	44.0	684 001	732 840	973 601	42.3
Pacific Ocean Basin	6 816	8 804	8 428	23.6	6 704	6 959	9 614	43.4
Columbia River	590	1 025	524	-11.3	3 625	3 018	3 423	-5.6
Fraser River	5 714	7 418	7 170	25.5	2 690	3 441	5 091	89.2
Pacific Ocean, North Coastal	53	60	36	-31.5	176	253	297	68.6
Pacific Ocean, South Coastal	459	302	698	52.0	213	246	803	278.1
Gulf of Mexico Basin	0	0	0	0.0	411 805	382 027	425 211	3.3
Missouri River	0	0	0	0.0	411 805	382 027	425 211	3.3
Canada	498 048	545 415	846 261	69.9	16 546 928	15 799 840	18 372 716	11.0

¹ Monoculture is defined as the planting of one crop type on a continuous year-to-year basis. Monoculture cropland in the above table is cropland on monoculture farms (eighty percent or more of cropland on these farms is continuously under one crop type). For more detail see the Technical Box 3.1.17.

Source:
 Statistics Canada, Census of Agriculture, 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:
 Individual items may not add to totals due to rounding.

Table 3.1.29
Number of Cattle and Pigs by Ecozone, 1971, 1976 and 1981

Ecozone	Cattle				Pigs			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
				percent				percent
Atlantic Maritime	535 026	556 065	522 218	-2.4	326 573	247 880	425 447	30.3
Prince Edward Island	106 062	110 396	102 454	-3.4	100 936	78 691	116 843	15.8
Nova Scotia	130 920	137 164	140 209	7.1	79 765	73 433	139 344	74.7
New Brunswick	112 427	120 932	110 904	-1.4	56 308	39 961	89 618	59.2
Québec	185 587	187 573	168 651	-9.1	89 564	55 795	79 642	-11.0
Mixed-Wood Plain	4 189 942	4 226 714	3 941 356	-5.9	3 525 963	3 387 912	6 347 426	80.0
Québec	1 304 007	1 274 095	1 230 963	-5.6	1 191 770	1 488 987	3 205 765	169.0
Ontario	2 885 935	2 952 619	2 710 393	-6.1	2 334 193	1 898 925	3 141 661	34.6
Boreal Shield	502 914	523 480	468 216	-6.9	147 857	104 614	201 152	36.0
Newfoundland	7 138	7 061	6 963	-2.5	14 639	15 795	19 076	30.3
New Brunswick	229	156	38	-83.4	22	11	15	-47.0
Québec	291 179	297 725	266 077	-8.6	102 247	72 377	155 302	51.9
Ontario	196 080	206 889	188 101	-4.1	27 474	14 736	24 176	-11.9
Manitoba	8 288	11 649	7 037	-15.1	3 475	1 695	2 583	-25.6
Prairie	6 079 604	7 156 302	6 093 071	0.2	3 128 454	1 617 586	2 151 895	-31.1
Manitoba	864 680	1 047 788	877 786	1.5	917 674	522 916	729 947	-20.4
Saskatchewan	2 289 083	2 648 040	2 053 899	-10.3	925 592	418 263	491 012	-46.9
Alberta	2 925 841	3 460 474	3 161 386	8.1	1 285 188	676 407	930 936	-27.5
Boreal Plain	1 390 477	2 010 988	1 737 334	24.9	910 986	380 998	508 827	-44.0
Manitoba	265 107	340 440	291 143	9.8	149 422	101 323	142 465	-4.6
Saskatchewan	355 948	484 380	364 558	2.4	219 682	73 006	83 322	-62.0
Alberta	744 120	1 123 927	1 003 939	34.9	529 978	201 584	268 311	-49.2
British Columbia	25 302	62 241	77 694	207.1	12 209	5 085	14 729	20.6
Montane Cordillera	411 956	480 078	535 623	30.0	22 068	13 214	69 039	212.8
Alberta	32 416	29 971	27 562	-15.0	376	222	150	-60.0
British Columbia	379 540	450 107	508 061	33.9	21 692	12 992	68 889	217.6
Pacific Maritime	164 557	173 966	200 131	21.6	44 170	37 434	170 881	286.9
British Columbia	164 557	173 966	200 131	21.6	44 170	37 434	170 881	286.9
Boreal Cordillera	3 772	4 129	3 955	4.9	550	38	396	-27.9
British Columbia	3 772	4 129	3 955	4.9	550	38	396	-27.9
Canada	13 278 233	15 131 723	13 501 904	1.7	8 106 926	5 789 676	9 875 065	21.8

Source:
Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:
The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield have been allocated to the Boreal Plain. These adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Table 3.1.30
Number of Poultry by Ecozone, 1971, 1976 and 1981

Ecozone	Chickens ¹				Other Poultry ²			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
				percent				percent
Atlantic Maritime	6 035 323	5 904 791	6 373 592	5.6	131 470	243 661	209 387	59.2
Prince Edward Island	268 642	268 252	222 729	-17.1	8 074	7 943	10 680	32.3
Nova Scotia	3 055 813	2 992 860	3 435 103	12.4	74 606	134 323	103 765	39.1
New Brunswick	1 761 933	2 046 451	2 241 146	27.2	35 575	96 099	88 256	148.1
Québec	948 935	597 228	474 614	-50.0	13 215	5 296	6 686	-49.4
Mixed-Wood Plain	49 472 229	49 199 220	52 094 047	5.3	6 144 173	5 958 662	5 991 798	-2.5
Québec	18 774 762	19 603 170	18 606 522	-0.9	2 175 397	1 674 527	1 679 278	-22.8
Ontario	30 697 467	29 596 050	33 487 525	9.1	3 968 776	4 284 135	4 312 520	8.7
Boreal Shield	4 654 916	4 238 912	4 636 761	-0.4	323 857	375 576	329 670	1.8
Newfoundland	808 919	943 459	932 117	15.2	2 398	3 782	3 438	43.3
New Brunswick	49	37	15	-69.4	0	0	0	0.0
Québec	2 862 446	2 819 678	3 158 090	10.3	296 206	326 446	313 130	5.7
Ontario	812 496	376 146	427 680	-47.4	24 541	41 563	11 371	-53.7
Manitoba	171 006	99 592	118 859	-30.5	712	3 785	1 731	143.1
Prairie	16 622 519	15 585 931	17 212 652	3.6	2 645 647	2 024 623	2 191 279	-17.1
Manitoba	5 571 870	5 034 805	5 310 346	-4.7	1 079 335	775 835	782 696	-27.5
Saskatchewan	4 528 259	3 718 180	3 988 696	-11.9	628 461	398 442	419 613	-33.2
Alberta	6 522 390	6 832 946	7 913 610	21.3	937 851	850 346	988 970	5.5
Boreal Plain	2 975 411	2 418 097	2 454 737	-17.5	435 525	412 100	423 698	-2.8
Manitoba	934 939	723 516	725 837	-22.3	256 872	246 246	290 851	13.2
Saskatchewan	553 675	499 246	421 889	-23.8	27 830	19 045	16 352	-41.2
Alberta	1 396 518	1 137 495	1 253 020	-10.3	148 892	143 280	111 798	-24.9
British Columbia	90 279	57 840	53 991	-40.2	1 931	3 529	4 697	143.2
Montane Cordillera	569 877	585 368	890 847	56.3	102 150	119 709	101 263	-0.9
Alberta	4 235	3 941	23 895	464.2	146	132	194	32.9
British Columbia	565 642	581 427	866 952	53.3	102 004	119 577	101 069	-0.9
Pacific Maritime	7 204 829	9 138 685	9 045 003	25.5	729 447	624 978	667 602	-8.5
British Columbia	7 204 829	9 138 685	9 045 003	25.5	729 447	624 978	667 602	-8.5
Boreal Cordillera	2 075	1 996	10 290	395.9	93	168	220	136.6
British Columbia	2 075	1 996	10 290	395.9	93	168	220	136.6
Canada	87 537 179	87 073 000	92 717 929	5.9	10 512 362	9 759 477	9 914 917	-5.7

¹ Chickens refers to hens, pullets, broiler chickens, and cockerels.

² Other poultry refers to turkeys, geese and ducks.

Source:

Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Notes:

The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield have been allocated to the Boreal Plain. These adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Table 3.1.31
Number of Cattle and Pigs by Major Drainage Area, 1971, 1976 and 1981

Major Drainage Area	Cattle				Pigs			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
				percent				percent
Atlantic Ocean Basin	5 150 076	5 207 092	4 851 279	-5.8	3 989 759	3 736 097	6 964 196	74.6
Atlantic Ocean Coastal	22 541	21 816	22 380	-0.7	23 258	23 495	29 278	25.9
Gulf of St. Lawrence Coastal	313 982	322 929	294 258	-6.3	184 805	122 975	184 431	-0.2
Bay of Fundy Coastal and Saint John River	193 954	203 827	192 656	-0.7	107 566	86 466	181 360	68.6
St. Lawrence River	1 526 040	1 485 322	1 426 774	-6.5	1 304 666	1 583 675	3 402 642	160.8
Ottawa River	621 477	610 792	595 700	-4.1	119 856	76 434	166 298	38.7
Lake Ontario Shore	563 201	533 050	491 072	-12.8	317 169	216 073	320 719	1.1
Lake Erie and Lake St. Clair Shore	898 655	950 655	832 951	-7.3	1 251 517	1 104 556	1 776 606	42.0
Lake Huron Shore	997 557	1 064 347	983 109	-1.4	677 942	520 974	901 446	33.0
Lake Superior Shore	12 669	14 354	12 379	-2.3	2 980	1 449	1 416	-52.5
Hudson Bay and Ungava Bay Basin	6 980 393	8 433 447	7 148 674	2.4	3 695 137	1 865 567	2 483 881	-32.8
Hudson Bay and Ungava Bay Coastal	206 767	279 577	241 893	17.0	77 048	26 542	40 728	-47.1
Lake Winnipeg Shore	825 167	1 058 360	870 494	5.5	838 365	506 788	710 631	-15.2
Assiniboine River	1 609 840	1 879 648	1 470 898	-8.6	730 356	331 130	414 830	-43.2
Saskatchewan River	4 338 619	5 215 862	4 565 389	5.2	2 049 368	1 001 107	1 317 692	-35.7
Arctic Ocean Basin	366 842	611 905	574 915	56.7	328 854	121 681	172 569	-47.5
Mackenzie River	366 842	611 905	574 915	56.7	328 854	121 681	172 569	-47.5
Pacific Ocean Basin	543 766	623 576	707 762	30.2	65 862	50 382	239 760	264.0
Columbia River	104 513	109 619	120 455	15.3	10 805	6 145	24 365	125.5
Fraser River	389 574	458 414	522 616	34.2	49 620	38 714	203 093	309.3
Pacific Ocean, North Coastal	20 171	23 928	26 217	30.0	348	514	541	55.5
Pacific Ocean, South Coastal	29 508	31 615	38 474	30.4	5 089	5 009	11 761	131.1
Gulf of Mexico Basin	237 156	255 703	219 274	-7.5	27 314	15 949	14 659	-46.3
Missouri River	237 156	255 703	219 274	-7.5	27 314	15 949	14 659	-46.3
Canada	13 278 233	15 131 723	13 501 904	1.7	8 106 926	5 789 676	9 875 065	21.8

Source:
 Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:
 Individual items may not add to totals due to rounding.

Table 3.1.32
Number of Poultry by Major Drainage Area, 1971, 1976 and 1981

	Chickens ¹				Other Poultry ²			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
				percent				percent
Atlantic Ocean Basin	59 871 321	59 097 065	62 863 360	5.0	6 597 453	6 571 524	6 526 377	-1.1
Atlantic Ocean Coastal	1 143 625	1 161 506	991 557	-13.3	25 476	26 727	20 479	-19.6
Gulf of St. Lawrence Coastal	1 655 267	1 694 477	1 494 272	-9.7	13 510	25 244	37 216	175.5
Bay of Fundy Coastal and Saint John River	3 610 528	3 677 351	4 601 797	27.5	86 074	194 784	152 828	77.6
St. Lawrence River	22 548 941	23 311 639	22 764 594	1.0	2 473 516	1 997 689	1 979 528	-20.0
Ottawa River	1 878 655	1 547 431	1 687 855	-10.2	25 220	19 863	36 516	44.8
Lake Ontario Shore	8 858 814	9 223 264	10 985 810	24.0	885 527	1 130 733	1 246 697	40.8
Lake Erie and Lake St. Clair Shore	12 157 979	11 991 783	12 468 777	2.6	2 332 894	2 560 536	2 475 233	6.1
Lake Huron Shore	7 876 346	6 379 757	7 768 970	-1.4	754 907	615 142	577 017	-23.6
Lake Superior Shore	141 166	109 857	99 728	-29.4	329	806	863	162.3
Hudson Bay and Ungava Bay Basin	18 831 391	17 454 220	18 993 314	0.9	2 892 808	2 348 349	2 556 158	-11.6
Hudson Bay and Ungava Bay Coastal	304 689	289 481	243 991	-19.9	8 127	7 988	7 760	-4.5
Lake Winnipeg Shore	5 856 408	5 408 394	5 694 623	-2.8	980 708	801 261	819 704	-16.4
Assiniboine River	3 705 062	2 808 022	2 851 045	-23.1	691 591	389 865	426 672	-38.3
Saskatchewan River	8 965 232	8 948 323	10 203 655	13.8	1 212 382	1 149 235	1 302 022	7.4
Arctic Ocean Basin	940 643	736 450	884 655	-6.0	103 910	88 928	55 462	-46.6
Mackenzie River	940 643	736 450	884 655	-6.0	103 910	88 928	55 462	-46.6
Pacific Ocean Basin	7 768 857	9 712 227	9 911 106	27.6	831 438	744 522	768 646	-7.6
Columbia River	230 015	167 141	403 747	75.5	56 590	77 608	58 263	3.0
Fraser River	6 792 242	8 658 035	8 406 449	23.8	746 900	631 611	679 400	-9.0
Pacific Ocean, North Coastal	60 535	55 470	56 365	-6.9	477	1 922	1 309	174.4
Pacific Ocean, South Coastal	686 065	831 581	1 044 545	52.3	27 471	33 381	29 674	8.0
Gulf of Mexico Basin	124 967	73 038	65 494	-47.6	11 847	6 154	8 274	-30.2
Missouri River	124 967	73 038	65 494	-47.6	11 847	6 154	8 274	-30.2
Canada	87 537 179	87 073 000	92 717 929	5.9	10 437 456	9 759 477	9 914 917	-5.0

¹ Chickens refers to hens, pullets, broiler chickens, and cockerels.

² Other Poultry refers to turkeys, geese and ducks.

Note:

Individual items may not add to totals due to rounding.

Source:

Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Table 3.1.33
Fertilizer¹ Application on Farmland by Ecozone, 1970 and 1980

Ecozone	Area			Quantity	
	1970	1980	Change 1970 to 1980	1980	1980
	hectares		percent	tonnes	kilograms/hectare
Atlantic Maritime	164 661	335 693	103.9	160 210	477.3
Prince Edward Island	53 099	100 525	89.3	53 460	531.8
Nova Scotia	29 713	69 975	135.5	27 860	398.1
New Brunswick	33 255	66 512	100.0	48 975	736.3
Québec	48 594	98 681	103.1	29 915	303.2
Mixed-Wood Plain	1 468 416	3 096 017	110.8	1 285 657	415.3
Québec	313 944	750 912	139.2	350 245	466.4
Ontario	1 154 472	2 345 105	103.1	935 412	398.9
Boreal Shield	75 667	184 364	143.7	55 938	303.4
Newfoundland	1 463	2 777	89.8	2 406	866.4
New Brunswick	5	46	820.0	13	282.6
Québec	35 239	84 818	140.7	32 182	379.4
Ontario	35 828	88 450	146.9	19 835	224.3
Manitoba	3 137	8 273	163.7	1 502	181.6
Prairie	3 745 427	11 313 319	202.1	1 417 137	125.3
Manitoba	1 041 770	2 795 197	168.3	479 081	171.4
Saskatchewan	1 077 212	4 458 000	313.8	403 984	90.6
Alberta	1 626 445	4 060 122	149.6	534 072	131.5
Boreal Plain	1 181 855	2 810 673	137.8	385 537	137.2
Manitoba	136 175	367 576	169.9	58 780	159.9
Saskatchewan	417 137	1 039 000	149.1	133 385	128.4
Alberta	578 929	1 257 834	117.3	170 905	135.9
British Columbia	49 614	146 263	194.8	22 467	153.6
Montane Cordillera	45 890	133 272	190.4	31 057	233.0
Alberta	2 282	5 339	133.9	789	147.8
British Columbia	43 608	127 933	193.4	30 268	236.6
Pacific Maritime	23 282	54 980	136.1	34 480	627.1
British Columbia	23 282	54 980	136.1	34 480	627.1
Boreal Cordillera	1 060	1 131	6.7	182	160.9
British Columbia	1 060	1 131	6.7	182	160.9
Canada	6 706 262	17 929 448	167.4	3 370 198	188.0

¹ These data refer to commercial fertilizer applied in the crop years 1970 and 1980. The area fertilized is counted only once no matter how many applications were made.

Source:
Statistics Canada, Census of Agriculture 1971 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

Note:

The data for the Hudson Bay Plain have been allocated to the Boreal Shield and data for both the Taiga Plain and the Taiga Shield have been allocated to the Boreal Plain. These minor adjustments were made to conform to confidentiality restrictions.

Table 3.1.34
Agricultural Pesticide¹ Application on Farmland by Ecozone, 1970 and 1980

Ecozone	Area Sprayed/Dusted					
	with Herbicides			with Insecticides		
	1970	1980	Change 1970 to 1980	1970	1980	Change 1970 to 1980
	hectares		percent	hectares		percent
Atlantic Maritime	92 532	158 528	71.3	64 113	74 271	15.8
Prince Edward Island	43 143	81 789	89.6	25 916	31 984	23.4
Nova Scotia	15 567	20 863	34.0	9 971	11 109	11.4
New Brunswick	29 403	40 179	36.6	24 738	26 832	8.5
Québec	4 419	15 698	255.2	3 488	4 345	24.6
Mixed-Wood Plain	1 265 523	2 271 589	79.5	281 234	459 170	63.3
Québec	157 634	370 860	135.3	49 120	77 465	57.7
Ontario	1 107 889	1 900 729	71.6	232 114	381 706	64.4
Boreal Shield	15 474	44 271	186.1	5 301	11 123	109.8
Newfoundland	369	499	35.3	497	671	35.0
New Brunswick	0	0	0.0	0	0	0.0
Québec	3 996	14 272	257.2	2 988	6 539	118.8
Ontario	8 282	22 894	176.4	1 483	2 343	58.0
Manitoba	2 827	6 605	133.6	333	1 570	371.5
Prairie	6 365 179	10 752 283	68.9	457 723	891 193	94.7
Manitoba	1 509 116	2 226 610	47.5	114 154	236 525	107.2
Saskatchewan	2 907 696	4 491 540	54.5	205 389	484 446	135.9
Alberta	1 948 367	4 034 133	107.1	138 180	170 222	23.2
Boreal Plain	804 038	1 948 303	142.3	75 779	191 104	152.2
Manitoba	185 250	294 704	59.1	12 088	21 678	79.3
Saskatchewan	332 966	852 185	155.9	38 887	123 750	218.2
Alberta	257 228	721 764	180.6	23 432	39 932	70.4
British Columbia	28 594	79 650	178.6	1 372	5 745	318.7
Montane Cordillera	16 057	25 702	60.1	18 007	13 639	-24.3
Alberta	1 732	3 908	125.6	69	0	-100.0
British Columbia	14 325	21 794	52.1	17 938	13 639	-24.0
Pacific Maritime	11 222	19 548	74.2	11 349	11 434	0.8
British Columbia	11 222	19 548	74.2	11 349	11 434	0.8
Boreal Cordillera	1 070	400	-62.6	0	207	...
British Columbia	1 070	400	-62.6	0	207	...
Canada	8 571 099	15 220 407	77.6	913 508	1 652 142	80.9

¹ These data refer to the crop years 1970 and 1980 although they are derived from 1971 and 1981 Census responses. The area sprayed/dusted is counted only once for herbicide and once for insecticide no matter how many applications were made.

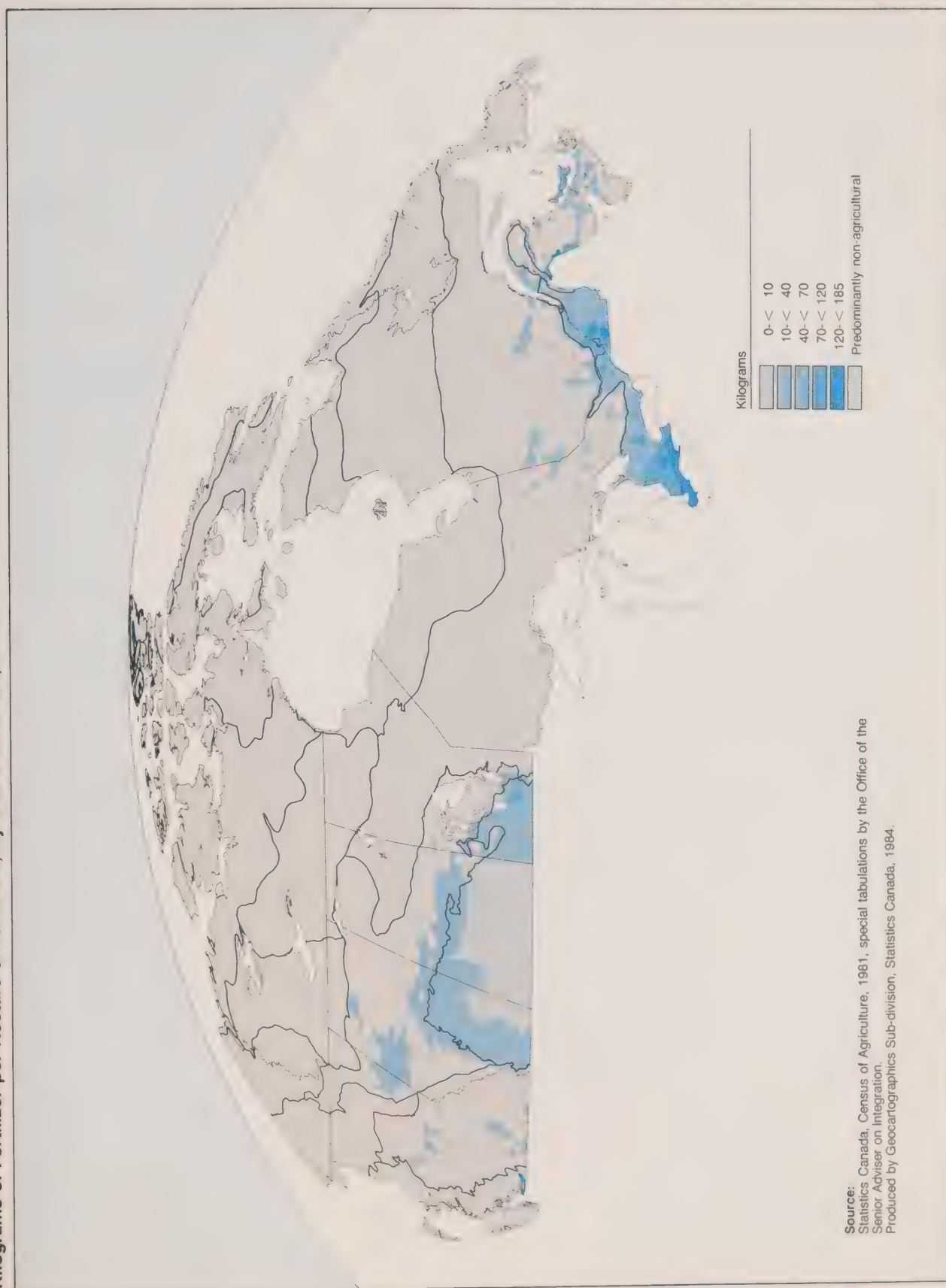
Source:

Statistics Canada, Census of Agriculture 1971 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Notes:

The data for the Hudson Bay Plain have been allocated to the Boreal Shield and the data for both the Taiga Shield and the Taiga Plain have been allocated to the Boreal Plain. These minor adjustments were made to conform to confidentiality restrictions. It should also be noted that individual items may not add to totals due to rounding.

Map 3.1.35
 Kilograms of Fertilizer per Hectare of Farmland, by Census Division, 1980



98 Map 3.1.36
Percentage of Farmland Sprayed or Dusted with Pesticides, by Census Division, 1980

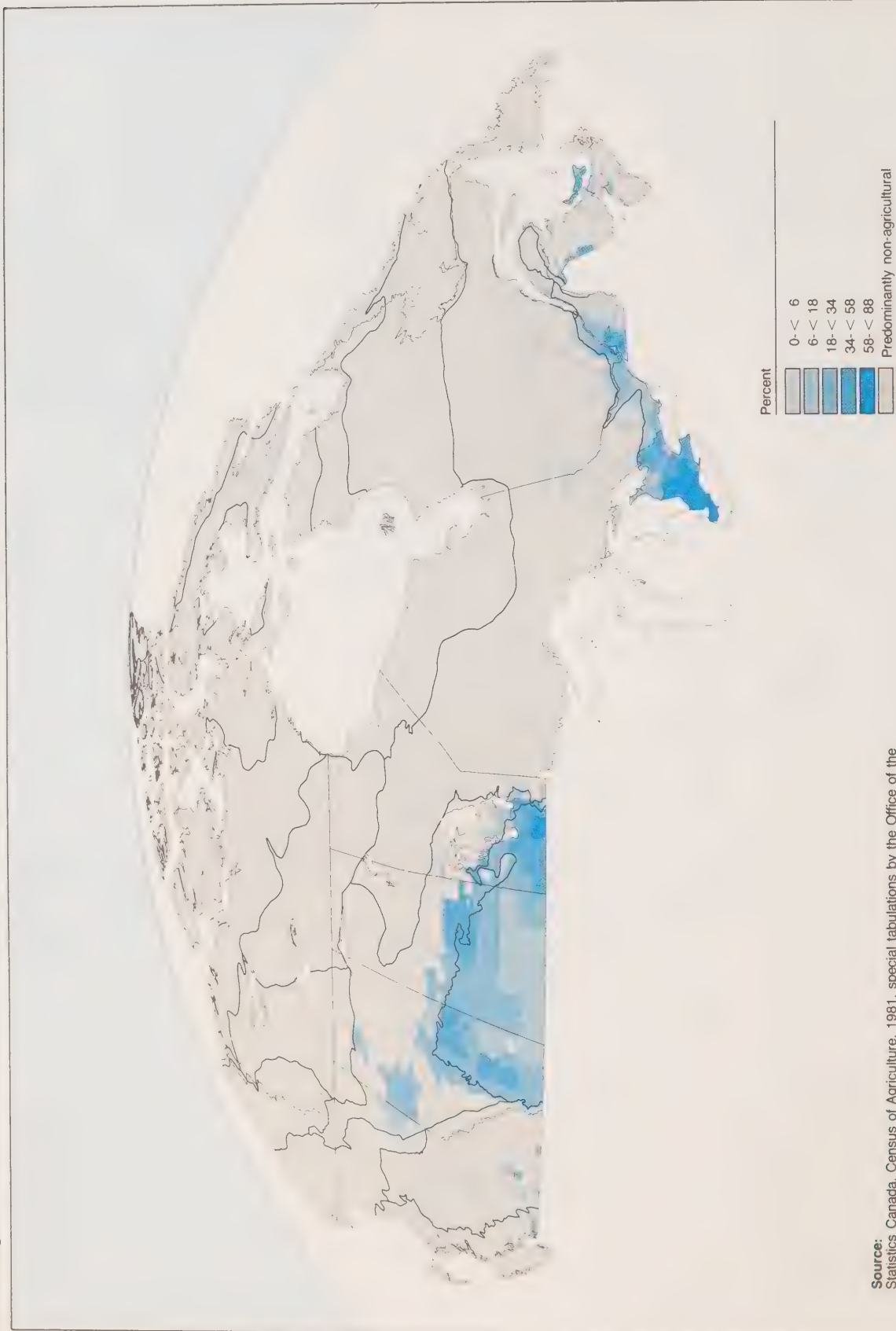


Table 3.1.37
Fertilizer Application on Farmland by Major Drainage Area, 1970 and 1980

Major Drainage Area	Area			Quantity	
	1970	1980	Change 1970-80	1980	1980
	hectares		percent	tonnes	kilograms/hectare
Atlantic Ocean Basin	1 693 889	3 578 781	111.3	1 494 196	417.5
Atlantic Ocean Coastal	3 400	8 064	137.2	3 761	466.4
Gulf of St. Lawrence Coastal	104 735	208 779	99.3	89 174	427.1
Bay of Fundy Coastal and Saint John River	53 672	111 112	107.0	65 107	586.0
St. Lawrence River	348 161	835 811	140.1	378 865	453.3
Ottawa River	105 219	252 844	140.3	87 095	344.5
Lake Ontario Shore	150 444	352 211	134.1	128 121	363.8
Lake Erie and Lake St. Clair Shore	622 799	1 179 933	89.5	521 719	442.2
Lake Huron Shore	301 187	619 680	105.7	217 838	351.5
Lake Superior Shore	4 272	10 347	142.2	2 516	243.2
Hudson Bay and Ungava Bay Basin	4 437 070	12 968 313	192.3	1 653 785	127.5
Hudson Bay and Ungava Bay Coastal	65 196	185 644	184.7	28 735	154.8
Lake Winnipeg Shore	963 719	2 384 290	147.4	408 993	171.5
Assiniboine River	788 937	3 141 741	298.2	346 662	110.3
Saskatchewan River	2 619 218	7 256 639	177.1	869 395	119.8
Arctic Ocean Basin	492 771	1 108 341	124.9	150 101	135.4
Mackenzie River	492 771	1 108 341	124.9	150 101	135.4
Pacific Ocean Basin	66 856	182 759	173.4	64 711	354.1
Columbia River	18 189	39 841	119.0	13 446	337.5
Fraser River	39 970	119 513	199.0	43 115	360.8
Pacific Ocean, North Coastal	3 597	10 686	197.1	1 406	131.6
Pacific Ocean, South Coastal	5 100	12 718	149.4	6 744	530.3
Gulf of Mexico Basin	15 676	91 255	482.1	7 391	81.0
Missouri River	15 676	91 255	482.1	7 391	81.0
Canada	6 706 262	17 929 448	167.4	3 370 198	188.0

¹ These data refer to commercial fertilizer applied during the crop year 1970 and 1980. The area fertilized is counted only once no matter how many applications were made.

Source:

Statistics Canada, Census of Agriculture, 1971 and 1981, special tabulation by the Office of the Senior Advisor on Integration.

Note:

Individual items may not add to totals due to rounding.

Table 3.1.38
Agricultural Pesticide¹ Application on Farmland by Major Drainage Area, 1970 and 1980

Major Drainage Area	Area Sprayed/Dusted					
	with Herbicides			with Insecticides		
	1970	1980	Change 1970 to 1980	1970	1980	Change 1970 to 1980
	hectares		percent	hectares		percent
Atlantic Ocean Basin	1 369 815	2 465 402	80.0	350 136	542 788	55.0
Atlantic Ocean Coastal	1 021	1 169	14.5	785	645	-17.8
Gulf of St. Lawrence Coastal	52 775	101 590	92.5	29 481	37 356	26.7
Bay of Fundy Coastal and Saint John River	38 059	52 741	38.6	32 523	35 394	8.8
St. Lawrence River	173 930	402 765	131.6	53 765	82 279	53.0
Ottawa River	76 481	141 872	85.5	11 323	12 709	12.2
Lake Ontario Shore	151 029	262 628	73.9	40 992	49 748	21.4
Lake Erie and Lake St. Clair Shore	623 739	1 024 688	64.3	138 400	241 070	74.2
Lake Huron Shore	252 305	476 668	88.9	42 630	83 331	95.5
Lake Superior Shore	476	1 282	169.3	237	257	8.4
Hudson Bay and Ungava Bay Basin	6 822 547	11 835 803	73.5	504 125	1 036 823	105.7
Hudson Bay and Ungava Bay Coastal	39 765	114 285	187.4	3 573	7 071	97.9
Lake Winnipeg Shore	1 187 226	1 875 606	58.0	98 815	214 649	117.2
Assiniboine River	2 152 675	2 702 494	25.5	126 303	260 355	106.1
Saskatchewan River	3 442 881	7 143 418	107.5	275 434	554 748	101.4
Arctic Ocean Basin	201 392	644 923	220.2	19 612	40 691	107.5
Mackenzie River	201 392	644 923	220.2	19 612	40 691	107.5
Pacific Ocean Basin	25 548	41 342	61.8	29 286	25 106	-14.3
Columbia River	11 852	16 105	35.9	14 783	13 097	-11.4
Fraser River	12 460	22 958	84.3	13 414	11 125	-17.1
Pacific Ocean, North Coastal	161	627	289.4	36	20	-43.8
Pacific Ocean, South Coastal	1 075	1 653	53.7	1 053	863	-18.0
Gulf of Mexico Basin	151 798	232 971	53.5	10 349	6 735	-34.9
Missouri River	151 798	232 971	53.5	10 349	6 735	-34.9
Canada	8 571 099	15 220 407	77.6	913 508	1 652 142	80.9

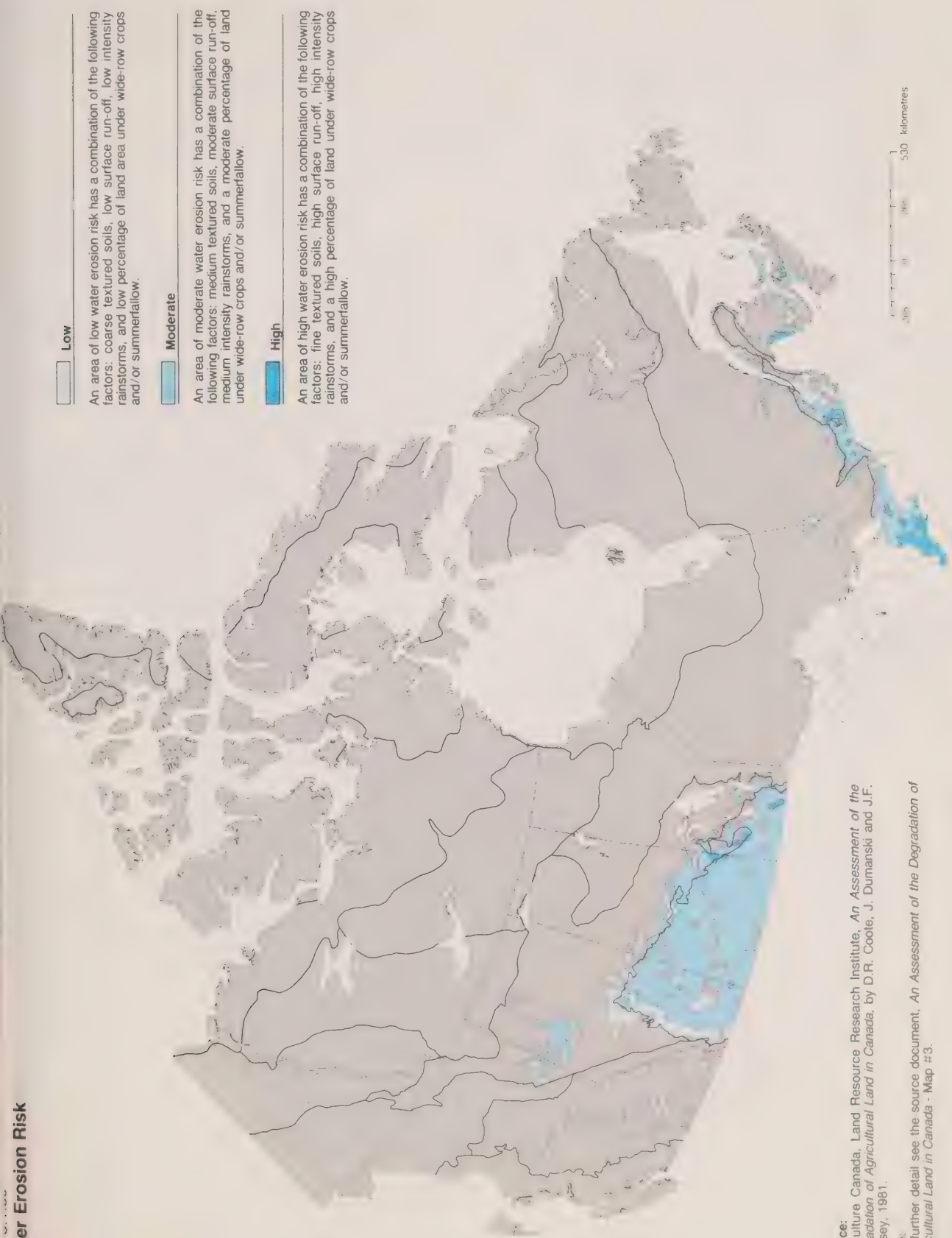
¹ These data refer to the crop years 1970 and 1980 although they are derived from 1971 and 1981 Census responses. The area sprayed/dusted is counted only once for herbicide and once for insecticide no matter how many applications were made.

Source:

Statistics Canada, 1971 and 1981 Census of Agriculture, special tabulation by the Office of the Senior Advisor on Integration.

Note:

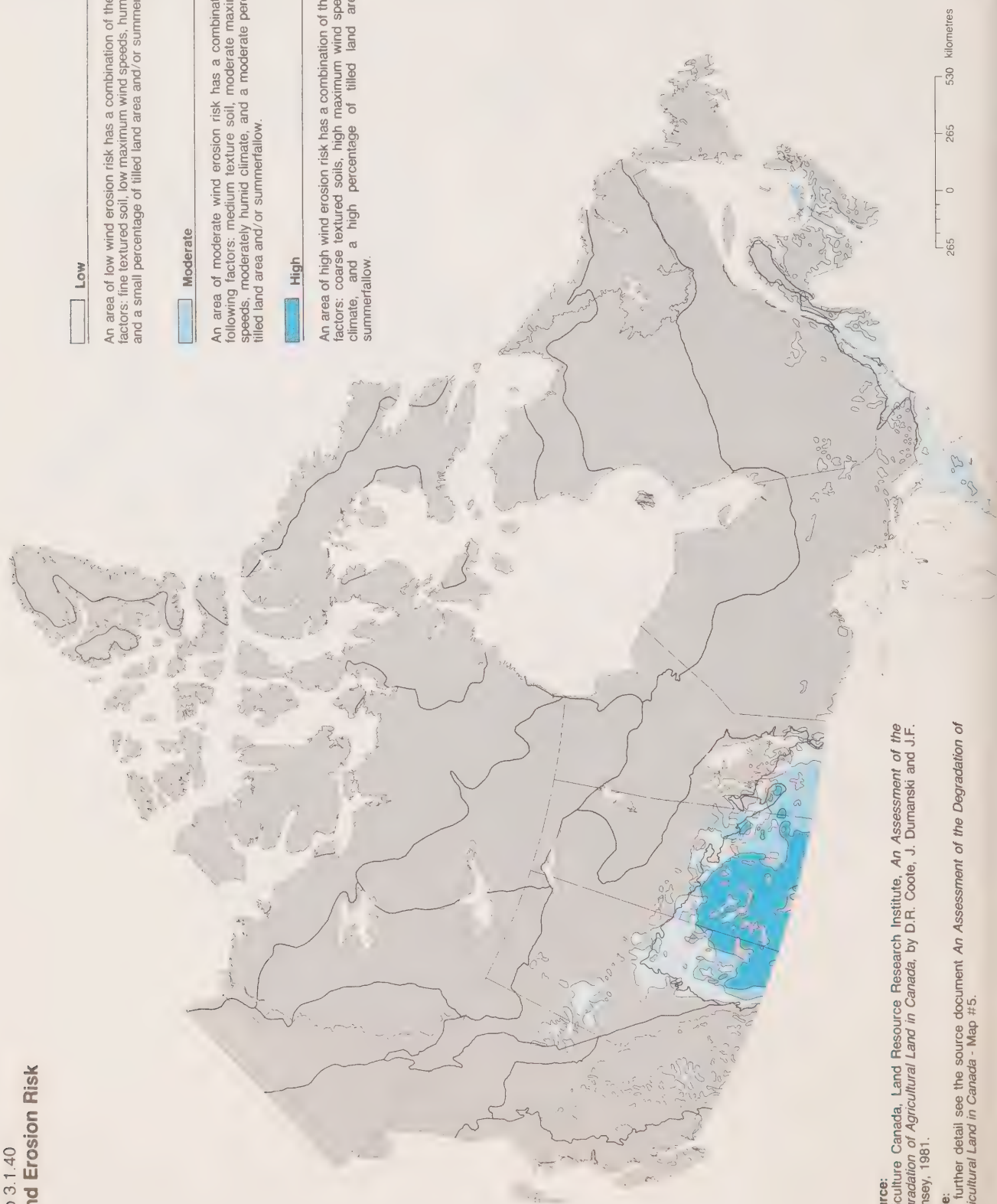
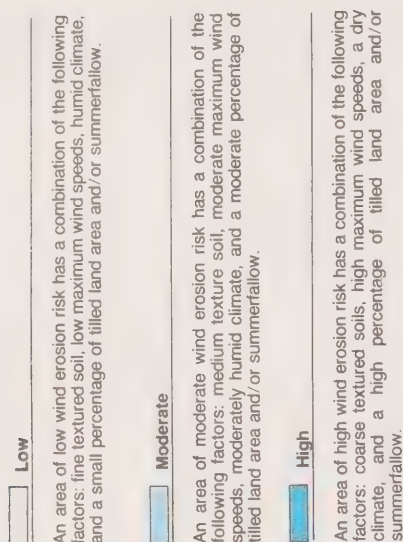
Individual items may not add to totals due to rounding.



Source: Agriculture Canada, Land Resource Research Institute, *An Assessment of the Degradation of Agricultural Land in Canada*, by D.R. Coole, J. Dumanski and J.F. Ramsey, 1981.

Note: For further detail see the source document, *An Assessment of the Degradation of Agricultural Land in Canada - Map #3*.

Map 3.1.40
Wind Erosion Risk



Source: Agriculture Canada, Land Resource Research Institute, *An Assessment of the Degradation of Agricultural Land in Canada*, by D.R. Coote, J. Dumanski and J.F. Ramsey, 1981.

Note: For further detail see the source document *An Assessment of the Degradation of Agricultural Land in Canada* - Map #5.

Table 3.1.41
Socio-Economic Profile of Persons Employed in Agriculture by Ecozone, 1981¹

Ecozone	Total Employed ²		Full Time Employed ³						
	Persons	Average Income ⁴	Persons	As a Percentage of Total Employed	Average Income ⁴	Percentage of Full Time Employed			
						Self-Employed ⁵	45 years and Over	Education level	
								Less than Grade Nine	Secondary
		dollars		percent	dollars		percent		
Atlantic Maritime	28 085	6 900	17 415	62	9 600	56	42	30	26
Prince Edward Island	5 710	7 100	3 825	67	9 500	61	42	31	23
Nova Scotia	8 810	6 700	5 430	62	9 600	48	41	21	32
New Brunswick	7 560	5 800	4 145	55	8 500	53	45	32	28
Québec	6 010	8 400	4 015	67	10 900	64	42	37	18
Great Lakes-St. Lawrence	186 825	8 500	133 655	72	10 800	58	42	32	23
Québec	53 915	9 700	40 980	76	11 800	58	38	40	21
Ontario	132 910	8 100	92 675	70	10 400	57	44	29	24
Central Canada	17 320	7 300	11 390	66	9 600	60	43	36	21
Newfoundland	1 335	6 600	690	52	10 300	48	49	37	23
Québec	9 425	7 900	5 990	64	10 500	60	39	38	18
Ontario	6 260	6 600	4 475	72	8 300	62	46	32	25
Manitoba	315	8 100	225	78	9 100	75	54	43	13
Western Canada	147 775	12 500	122 040	83	13 800	70	46	27	26
Manitoba	29 205	9 200	23 650	81	10 500	68	46	34	21
Saskatchewan	66 330	13 700	54 625	82	15 100	77	49	29	25
Alberta	52 240	12 700	43 765	84	14 100	63	43	21	30
Northwest Territories	38 350	9 900	31 875	83	10 800	75	50	36	21
Manitoba	6 295	8 200	5 430	86	9 000	72	52	48	14
Saskatchewan	11 600	10 200	9 195	79	11 400	78	51	39	18
Alberta	18 450	10 400	15 660	85	11 100	75	49	31	23
British Columbia	2 000	9 400	1 595	80	11 100	75	40	24	37
Western Cordillera	13 420	7 800	8 990	67	9 900	59	47	22	35
Alberta	300	7 700	235	78	8 700	53	46	18	41
British Columbia	13 120	7 800	8 760	67	10 000	59	47	22	35
Atlantic Provinces	16 955	9 100	11 290	67	12 000	43	39	17	35
British Columbia	16 955	9 100	11 290	67	12 000	43	39	17	35
Northwest Territories	160	11 200	125	78	13 200	57	29	14	43
British Columbia	80	9 700	65	81	10 200	69	38	18	29
Yukon	..	..	..	..	..	..	..	..	..

Standard industrial classification codes 011 to 019 and 021: all farms including experimental and institutional farms, plus services incidental to agriculture such as threshing and contract crop dusting.

¹ Employed in 1980.

² Employed 27 or more weeks in 1980.

⁴ Incomes appear to be low because of the reporting of negative income (expenses exceeding sales) by some farmers.

⁵ Self employed persons are full-time workers, less wage-earners, less unpaid family workers.

Source:

Statistics Canada, 1981 Census of Population, special tabulation.

Table 3.1.42
Economic Profile of Farms by Ecozone, 1980

Ecozone	Number of Farms	Farm Workers ¹	Labour Force per Thousand Hectares of Farmland	Total Sales of Agricultural Products	Total Sales of Agricultural Products per Thousand Hectares of Farmland	Total Capital Value ²	Total Capital Value per Thousand Hectares of Farmland	Total Value of Farm Machinery	Total Value of Farm Machinery per Thousand Hectares of Farmland
				thousands of current dollars	thousands of current dollars	millions of current dollars	thousands of current dollars	millions of current dollars	thousands of current dollars
Atlantic Maritime	16 771	28 085	17.5	618 740	384	2 913.5	1 810	594.2	369
Prince Edward Island	3 154	5 710	20.2	140 370	496	699.5	2 472	148.9	526
Nova Scotia	5 045	8 810	18.9	198 608	426	897.5	1 926	150.3	323
New Brunswick	4 060	7 560	17.3	153 586	352	666.5	1 527	141.2	323
Québec	4 512	6 010	14.2	126 177	298	650.0	1 533	153.7	362
Mixed-Wood Plain	113 373	186 825	23.7	6 289 604	797	38 016.1	4 819	4 677.1	593
Québec	36 713	53 915	21.1	1 706 063	666	7 755.0	3 029	1 373.0	536
Ontario	76 660	132 910	25.0	4 583 542	860	30 261.0	5 680	3 304.2	620
Boreal Shield	13 700	17 335	10.8	359 493	225	2 254.7	1 411	386.7	242
Newfoundland	679	1 335	39.9	28 343	847	115.6	3 455	12.4	371
New Brunswick	3	--	0.0	425	307	--	0	0.4	289
Québec	6 919	9 425	11.9	199 662	251	1 063.9	1 337	206.3	259
Ontario	5 788	6 260	0.0	108 124	152	1 022.0	1 437	157.9	222
Manitoba	311	315	5.6	22 939	408	52.9	941	9.9	176
Prairie	116 009	147 775	3.5	6 607 214	155	65 485.2	1 536	8 998.3	211
Manitoba	22 436	29 205	4.9	1 236 955	206	8 889.8	1 483	1 526.9	255
Saskatchewan	56 605	66 330	2.9	2 688 320	118	27 688.8	1 220	4 278.9	188
Alberta	36 968	52 240	3.8	2 681 938	193	28 906.6	2 075	3 192.5	229
Boreal Plain	40 141	38 350	3.1	1 222 491	115	13 732.2	1 297	2 202.6	208
Manitoba	6 697	6 295	3.1	201 200	129	1 508.2	964	286.8	183
Saskatchewan	10 711	11 600	3.6	389 794	120	3 679.7	1 133	638.0	196
Alberta	20 927	18 450	3.6	573 031	113	7 786.7	1 533	1 162.3	229
British Columbia	1 806	2 005	2.9	58 477	84	757.7	1 092	115.5	166
Montane Cordillera	9 866	13 420	9.7	259 727	188	3 738.3	2 699	318.6	230
Alberta	161	300	3.1	9 850	101	133.9	1 371	7.4	76
British Columbia	9 705	13 120	10.2	249 877	194	3 604.4	2 800	311.1	242
Pacific Maritime	8 436	16 955	99.6	490 145	2 879	4 143.3	24 337	263.5	1 548
British Columbia	8 436	16 955	99.6	490 145	2 879	4 143.3	24 337	263.5	1 548
Boreal Cordillera	65	160	5.9	1 154	43	21.0	775	3.2	118
British Columbia	65	80	3.0	1 154	43	21.0	775	3.2	118
Yukon	--	--	--	--	--	--	--	--	--
Canada	318 361	448 830	6.8	15 832 069	240	130 304	1 978	17 444	265

¹ Farm workers refers to persons aged 15 or over who worked one week or more in 1980.

² Capital value refers to value of buildings, land and livestock.

Source:

Statistics Canada, Census of Agriculture 1981, Census of Population 1981, special tabulation by the Office of the Senior Advisor on Integration.

Notes:

Individual items may not add to totals due to rounding.

3.2

Forestry



Technical Box 3.2.1

Canada's Forest Inventory

The purpose of the Forest Inventory is to provide readily accessible, consistent, and up-to-date information on the quantity, quality, and spatial distribution of the "productive forestlands" in Canada. The inventory data are stored on a data base maintained by the Canadian Forestry Service.

The data are obtained from provincial forest management agencies and are based largely on forest stand characteristics. In areas where provincial data are not available (e.g. Yukon, Northwest Territories, other non-managed provincial forestlands) the Canadian Forestry Service has compiled the inventory directly from various sources, including satellite imagery and aerial photographs.

Although the inventoried forests cover approximately 80 percent of the area referred to as "productive forestland", there is nevertheless a significant area of tree cover which is excluded. These areas are, for the most part, found in the northern margin of "productive forestland" which is characterized by low productivity and inaccessibility for harvest. Bordering the southern edge of the forestland are the areas referred to as "predominantly agricultural". These lands, are interspersed with woodlots and contain hardwood stands of species not found elsewhere in Canada.

A major purpose of Canada's Forest Inventory is to allow monitoring of forest productivity. This is reflected in the nature of the definitions, concepts and class structure employed in the Inventory.

Definitions and Concepts

Forest Type:

Softwood Forest: Stands where more than 75 percent of the canopy (i.e. tree cover) is coniferous.

Mixed-wood Forest: Stands where between 26 percent and 75 percent of the canopy is coniferous.

Hardwood Forest: Stands where less than 26 percent of the canopy is coniferous.

Productivity:

Productive Forest: Land capable of producing a merchantable stand within a reasonable length of time.

Unproductive Forest: Land incapable of producing a merchantable stand within a reasonable length of time, characterized by muskeg, barrens, marshes, meadows.

Stocked Forest: Land supporting tree growth including seedlings and saplings.

Non-stocked Forest: Land capable of producing trees but generally lacking in tree growth due to recent cut-over, burn, or disease.

Age of Forests:

Regeneration: Stands of new tree growth of less than one metre high, either generated naturally or planted by man.

Immature: Stands which are past the regeneration stage but insufficiently developed for harvesting.

Mature: Stands ready for harvesting (i.e. at or near rotation age).

Overmature: Stands of old trees where mortality rate may exceed new wood growth (i.e. past rotation age); characterized by openings in the canopy due to tree mortality.

Even-aged: Stands with small age differences in tree stock, usually less than 10 to 20 years, although for old forests (100 to 200 year trees) larger differences of up to 25 percent of rotation age may be classified as even-aged.

Uneven-aged: Stands where intermingling trees differ markedly in age, usually greater than 10 to 20 years.

Status:

Reserved Land: Forestland that by law or policy is not available for harvesting.

Nonreserved Land: Forestland that by law or policy is available for harvesting.

Inventory Coverage of Forestland¹

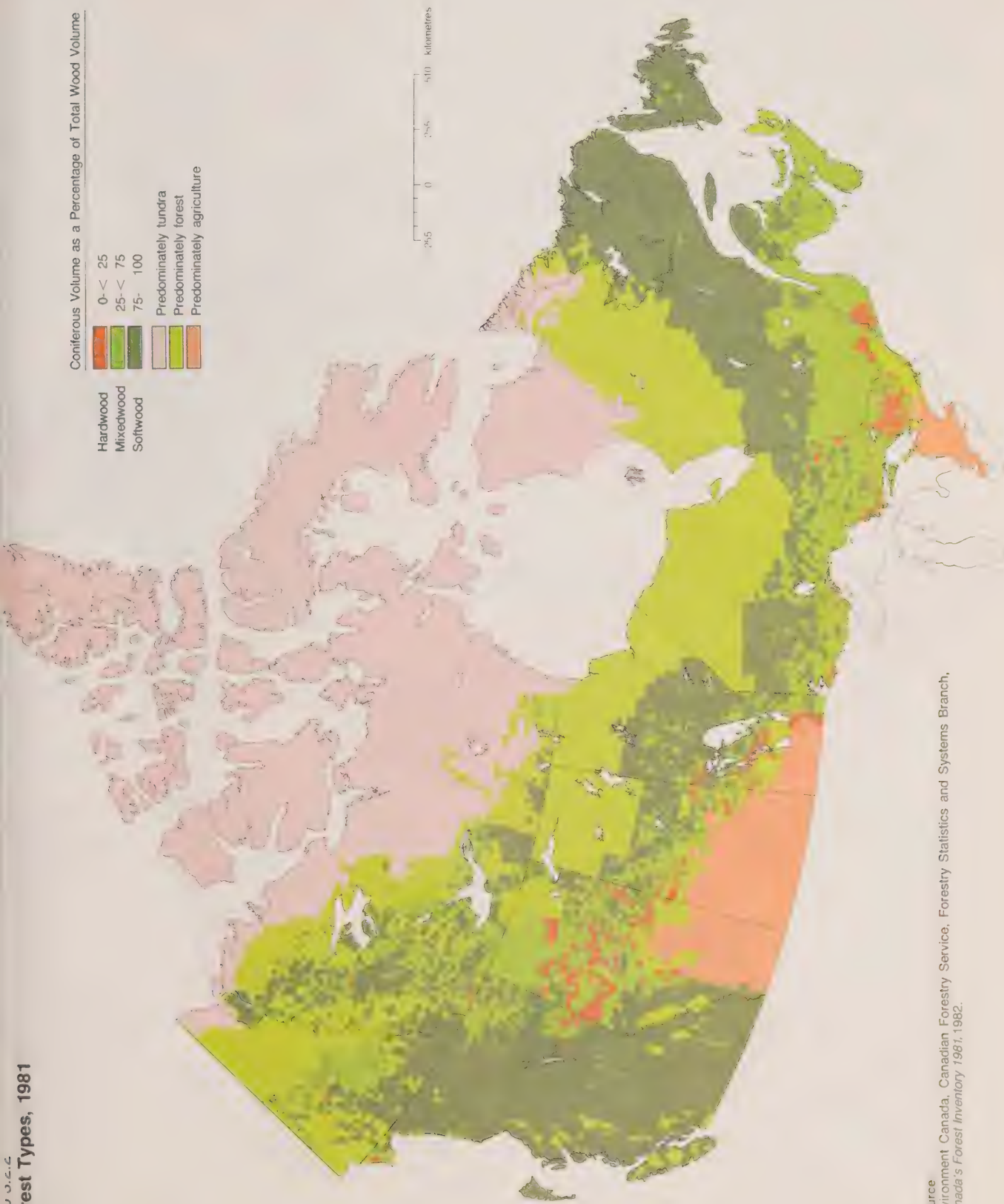
Province/Territory	Area of Forestland			Area of Productive Forestland		
	Inventoried	Noninventoried	Coverage of Inventory	Inventoried	Noninventoried	Coverage of Inventory
	thousands of square kilometres			thousands of square kilometres		
Newfoundland	142	0	100.0	85	0	100.0
Prince Edward Island	3	0	100.0	3	0	100.0
Nova Scotia	41	0	100.0	29	0	100.0
New Brunswick	65	0	100.0	62	0	100.0
Québec	624	316	66.4	533	316 ²	62.8
Ontario	432	375	53.5	377	49	88.5
Manitoba	240	109	68.8	139	3 ³	-
Saskatchewan	123	55	69.2	89	3 ³	-
Alberta	331	18	94.8	216	18	92.3
British Columbia	566	67	89.4	458	57	88.9
Yukon	242	0	100.0	67	0	100.0
Northwest Territories	615	0	100.0	143	0	100.0
Total	3 424	940	78.5	2 201	440	83.3

¹ Forestland is basically the area covered by trees. However, problems arise in providing estimates because the transition between treeless tundra and forestland is not sharp or is it clear where to draw the line between scattered farm woodlots and extensive tree cover. Methods of delineation between forestland

and non-forestland tend to vary from province to province.

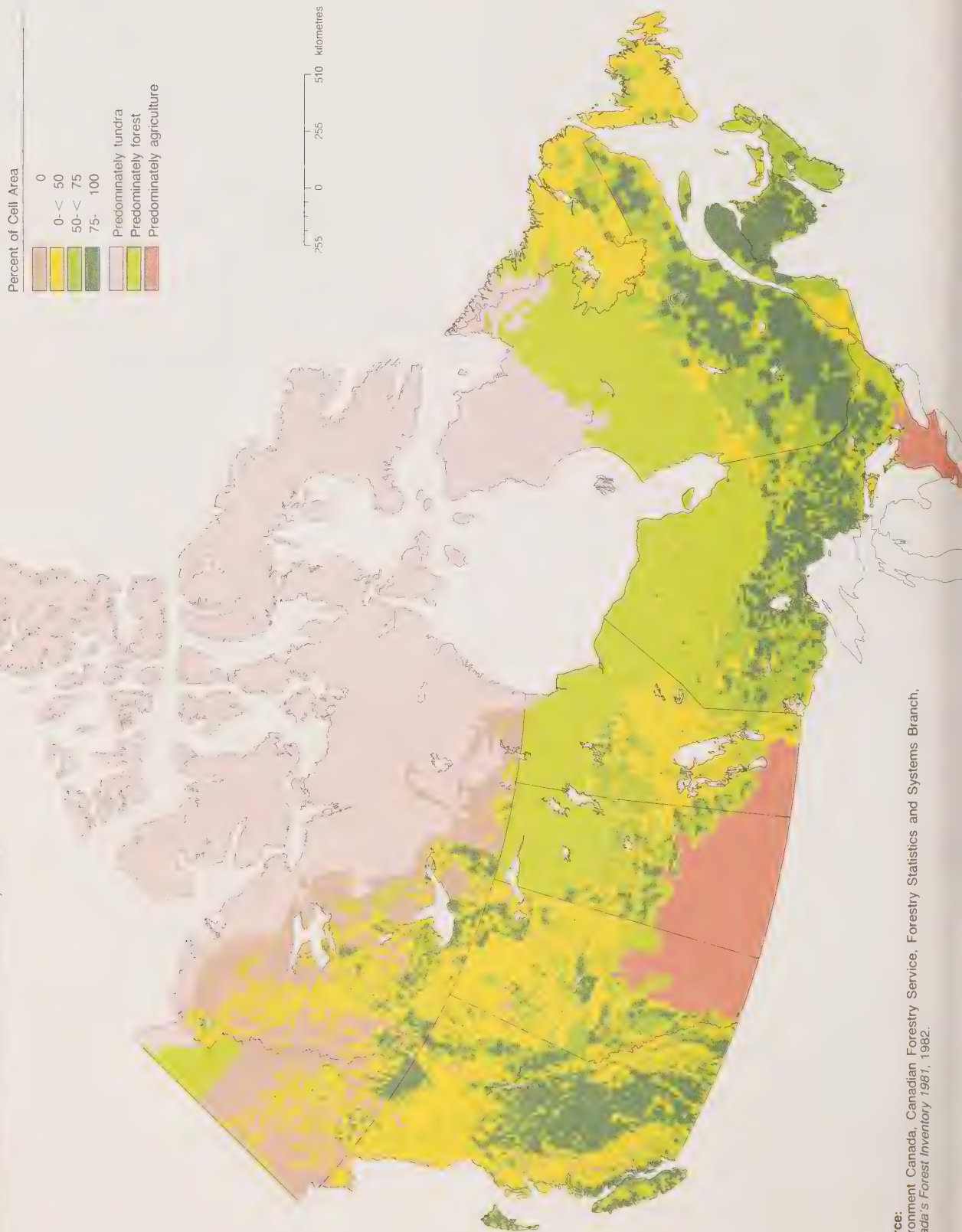
² Non-inventoried data available for Québec do not distinguish between unproductive and productive forestland.

³ Data are not available on non-inventoried productive forestland for Manitoba and Saskatchewan.



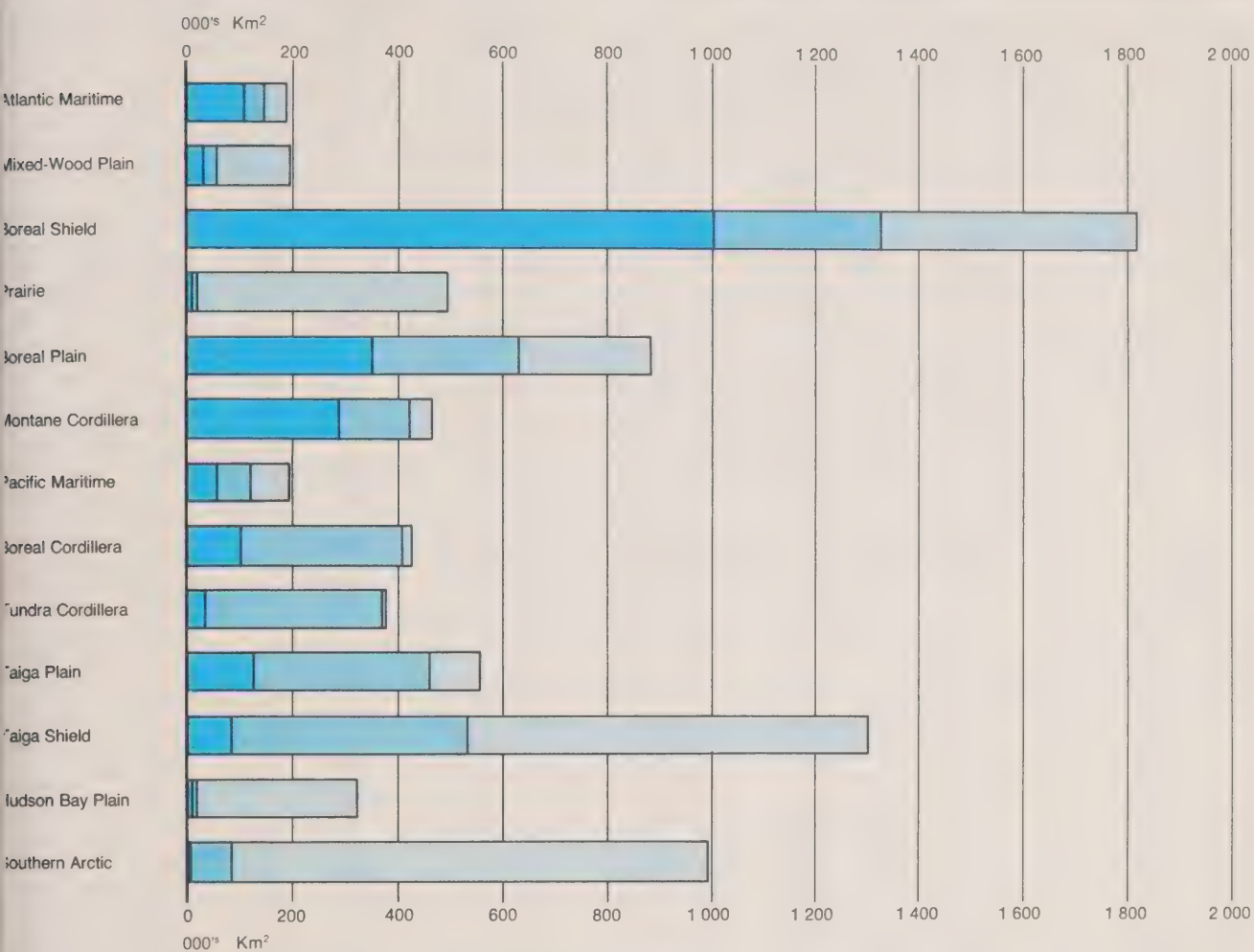
Source
Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch,
Canada's Forest Inventory 1981, 1982.

Map 3.2.3
Area of Stocked Productive Forestland, 1981



Source:
Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch,
Canada's Forest Inventory 1981, 1982.

Chart 3.2.4
Inventoried Forestland¹ in Relation to Ecozone Area, 1981



For definitions see Technical Box 3.2.1

Source: Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch.

■ Productive forestland¹
■ Inventoried non-productive forestland
■ Other land and freshwater

Table 3.2.5
Productivity and Status of Inventoried Forestland¹ by Ecozone, 1981

Ecozone	Productive, Inventoried, Non-Reserved Forestland ²			Inventoried ³ Reserved Forestland	Unproductive ⁴ Inventoried Forestland	Total ⁵ Inventoried Forestland	Proportion of Ecozone Area in Inventoried Forestland
	Stocked	Non-Stocked	Total				
thousands of square kilometres							percent
Atlantic Maritime	104.1	4.3	109.3	0.8	6.5	124.5	65.9
Nova Scotia	28.5	0.4	29.2	0.4	3.5	41.5	74.8
Prince Edward Island ⁵	2.5	0.4	2.9	..	0.1	2.9	51.2
New Brunswick	58.7	2.9	61.8	0.4	2.5	64.4	88.3
Québec	14.4	1.0	15.4	0.0	0.4	15.8	28.9
Mixed-Wood Plain	27.6	1.9	29.5	0.0	1.6	31.1	16.0
Québec	24.6	1.6	26.2	0.0	1.3	27.5	48.3
Ontario	3.0	0.3	3.2	0.0	0.3	3.5	2.5
Boreal Shield	900.5	94.0	1 006.2	8.9	241.2	1 247.5	68.6
Newfoundland	32.6	4.0	37.8	2.0	26.4	64.3	52.3
New Brunswick	0.2	0.0	0.2	0.0	0.0	0.2	40.8
Québec	440.7	39.9	481.1	0.5	80.0	561.2	80.9
Ontario	319.0	36.2	363.7	4.0	50.0	413.8	63.4
Manitoba	87.9	12.7	101.3	1.2	77.2	178.4	71.8
Saskatchewan	20.1	1.2	22.1	1.2	7.6	30.0	30.0
Prairie	4.2	0.5	6.1	1.9	0.8	7.0	1.4
Manitoba	3.1	0.4	4.3	0.9	0.7	5.0	7.1
Saskatchewan	0.9	0.0	0.4	0.6	0.0	1.5	0.6
Alberta	0.2	0.1	0.4	0.4	0.1	0.6	0.4
Boreal Plain	259.8	72.5	349.9	27.3	155.0	506.1	57.3
Manitoba	26.1	4.8	32.6	2.3	20.5	53.3	41.1
Saskatchewan	52.6	4.6	65.6	12.4	26.5	92.1	35.6
Alberta	113.2	53.7	171.7	12.2	80.8	253.5	67.4
British Columbia	51.4	7.8	61.8	0.2	21.4	83.5	88.9
Yukon	15.8	1.6	17.5	0.0	5.7	23.1	86.4
Northwest Territories	0.7	0.0	0.7	0.0	0.1	0.1	23.5
Montane Cordillera	257.5	14.3	284.4	18.1	32.3	316.8	68.4
Alberta	11.9	3.1	20.9	10.1	5.1	26.0	59.3
British Columbia	245.6	11.2	263.5	7.3	27.2	290.9	69.3
Pacific Maritime	48.7	1.6	51.5	1.5	17.0	68.5	34.8
British Columbia	48.7	1.6	51.5	1.5	17.0	68.5	34.8
Boreal Cordillera	78.8	18.3	101.0	5.1	119.9	220.8	51.9
British Columbia	55.5	4.1	63.5	2.6	33.1	96.6	46.5
Yukon	23.3	14.2	37.5	2.5	86.8	124.3	57.0
Tundra Cordillera	27.5	2.2	32.9	4.6	123.9	157.6	41.8
Yukon	10.1	2.2	12.3	0.0	82.1	94.5	41.5
Northwest Territories	17.4	0.0	20.6	4.6	41.8	63.1	42.3
Taiga Plain	106.1	11.4	126.8	10.9	265.2	407.5	73.1
Alberta	7.0	6.3	20.0	7.9	25.6	47.6	69.9
British Columbia	10.1	4.9	15.1	0.1	7.6	22.7	76.0
Northwest Territories	89.0	0.2	91.7	2.9	232.0	337.3	74.3
Taiga Shield	78.7	4.1	82.8	0.0	172.5	268.3	20.6
Newfoundland	45.2	0.7	45.9	0.0	31.2	77.1	34.0
Québec	5.9	1.2	7.1	0.0	4.0	11.1	0.2
Manitoba	0.7	0.1	0.8	0.0	1.6	2.4	2.0
Alberta	0.9	2.1	3.0	0.0	0.1	3.1	48.3
Northwest Territories	26.0	0.0	26.0	0.0	135.6	174.6	42.0
Hudson Bay Plain	6.2	0.6	6.9	0.1	8.8	15.7	4.2
Québec	2.1	0.3	2.4	0.0	4.9	7.4	85.8
Ontario	4.1	0.3	4.5	0.1	3.9	8.3	3.0
Southern Arctic	3.2	0.0	3.2	0.0	33.4	37.0	3.7
Newfoundland	0.4	0.0	0.4	0.0	0.0	0.4	0.7
Yukon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northwest Territories	2.8	0.0	2.8	0.0	33.4	36.5	4.7
Canada	1 903.0	225.7	2 190.5	79.0	1 178.2	3 408.4	33.4

¹ See Technical Box 3.2.1 for definitions.

² A proportion of the inventoried forestland is undetermined; therefore status or stocking condition could not be allocated. This undetermined portion however, is included in the total.

³ Reserved forestlands are predominantly found in national parks and provincial parks in which logging is not allowed.

⁴ Unproductive forestland is land incapable of producing a merchantable stand of timber.

⁵ Includes a portion of the inventory whose productive status is undetermined.

Source:

Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch, *Canada's Forest Inventory, 1981*.

Notes:

The minor differences between the Canada and Provincial totals here and those in *Canada's Forest Inventory, 1981* are due to the re-aggregation of the data to ecozones. Also, individual items may not add to totals due to rounding.

Table 3.2.6
Age Class¹ of Stocked, Productive, Inventoried Forestland² by Ecozone, 1981

Ecozone	Regeneration		Immature		Mature		Overmature		Uneven Aged		Total	
	Area	% of Ecozone Forest-land	Area	% of Ecozone Forest-land	Area	% of Ecozone Forest-land	Area	% of Ecozone Forest-land	Area	% of Ecozone Forest-land	Area	% of Ecozone Forest-land
	000s of km ²	%	000s of km ²	%	000s of km ²	%	000s of km ²	%	000s of km ²	%	000s of km ²	%
Atlantic Maritime	3.0	2.9	37.7	36.1	53.5	51.2	4.4	4.2	2.9	2.8	104.1	100.0
Nova Scotia	0.7	2.5	3.6	12.6	19.1	67.0	2.3	8.1	2.8	9.8	28.5	100.0
Prince Edward Island	..	..	..	..	..	..	..	..	..	..	2.5	100.0
New Brunswick	0.2	0.3	25.5	43.4	30.8	52.5	2.1	3.6	0.1	0.2	58.7	100.0
Québec	2.1	14.6	8.7	60.4	3.5	24.3	0.0	0.0	0.0	0.0	14.4	100.0
Mixed-Wood Plain	5.4	19.6	16.4	59.6	5.6	20.4	0.20	0.7	0.0	0.0	27.6	100.0
Québec	5.2	21.1	14.0	56.9	5.3	21.5	0.0	0.0	0.0	0.0	24.6	100.0
Ontario	0.2	6.7	2.4	80.0	0.2	6.7	0.2	6.7	0.0	0.0	3.0	100.0
Boreal Shield	85.7	9.5	410.6	45.6	318.6	35.4	46.6	5.2	0.0	0.0	900.5	100.0
Newfoundland	0.0	0.0	3.2	9.8	6.9	21.2	3.6	11.0	0.0	0.0	32.6	100.0
New Brunswick	0.0	0.0	0.0	0.0	0.1	50.0	0.0	0.0	0.0	0.0	0.2	100.0
Québec	60.0	13.6	116.7	26.5	263.7	59.8	0.0	0.0	0.0	0.0	440.8	100.0
Ontario	15.9	5.0	225.2	70.6	35.4	11.1	42.5	13.3	0.0	0.0	319.0	100.0
Manitoba	9.5	10.8	65.5	74.5	12.4	14.1	0.5	0.6	0.0	0.0	87.9	100.0
Saskatchewan	..	..	..	..	..	..	..	..	..	..	20.1	100.0
Prairie	0.2	4.8	2.4	57.1	1.3	31.0	0.1	2.4	0.0	0.0	4.2	100.0
Manitoba	0.2	6.5	1.9	61.3	1.0	32.3	0.1	3.2	0.0	0.0	3.1	100.0
Saskatchewan	..	..	..	..	..	..	..	..	..	..	0.9	100.0
Alberta	0.0	0.0	0.1	50.0	0.1	50.0	0.0	0.0	0.0	0.0	0.2	100.0
Boreal Plain	28.5	11.0	131.0	50.4	39.9	15.4	6.6	2.5	0.1	0.0	259.8	100.0
Manitoba	1.8	6.9	16.6	63.6	6.7	25.7	1.1	4.2	0.0	0.0	26.1	100.0
Saskatchewan	..	..	..	..	..	..	..	..	..	..	52.6	100.0
Alberta	13.9	12.3	76.7	67.8	15.3	13.5	5.6	4.9	0.0	0.0	113.2	100.0
British Columbia	6.9	13.4	28.1	54.7	16.3	31.7	0.0	0.0	0.1	0.2	51.4	100.0
Yukon	5.9	37.1	8.8	55.3	1.0	6.3	0.0	0.0	0.0	0.0	15.9	100.0
Northwest Territories	0.0	0.0	0.3	42.9	0.4	57.1	0.0	0.0	0.0	0.0	0.7	100.0
Montane Cordillera	6.8	2.6	105.6	41.0	142.0	55.1	1.4	0.5	1.6	0.6	257.5	100.0
Alberta	0.2	1.7	7.4	62.2	2.9	24.4	1.4	11.8	0.0	0.0	11.9	100.0
British Columbia	6.7	2.7	98.3	40.0	139.1	56.6	0.0	0.0	1.6	0.7	245.6	100.0
Pacific Maritime	2.0	4.1	9.4	19.3	37.2	76.4	0.0	0.0	0.1	0.2	48.7	100.0
British Columbia	2.0	4.1	9.4	19.3	37.2	76.4	0.0	0.0	0.1	0.2	48.7	100.0
Boreal Cordillera	12.0	15.2	30.2	38.4	36.3	46.1	0.0	0.0	0.0	0.0	78.8	100.0
British Columbia	2.2	4.0	18.6	33.5	34.7	62.5	0.0	0.0	0.0	0.0	55.5	100.0
Yukon	9.9	42.5	11.6	49.8	1.5	6.4	0.0	0.0	0.0	0.0	23.3	100.0
Tundra Cordillera	5.1	18.5	17.3	62.9	5.1	18.5	0.0	0.0	0.0	0.0	27.5	100.0
Yukon	3.9	38.6	5.8	57.4	0.5	5.0	0.0	0.0	0.0	0.0	10.1	100.0
Northwest Territories	1.2	6.9	11.5	66.5	4.6	26.6	0.0	0.0	0.0	0.0	17.3	100.0
Taiga Plain	5.9	5.6	64.5	60.8	35.5	33.5	0.2	0.2	0.0	0.0	106.1	100.0
Alberta	1.6	22.9	5.1	72.9	0.1	1.4	0.1	1.4	0.0	0.0	7.0	100.0
British Columbia	1.0	9.9	8.3	82.2	0.8	7.9	0.0	0.0	0.0	0.0	10.1	100.0
Northwest Territories	3.3	3.7	51.1	57.4	34.5	38.8	0.1	0.1	0.0	0.0	89.0	100.0
Taiga Shield	3.8	4.8	23.8	30.2	6.7	8.5	1.0	1.3	0.0	0.0	78.7	100.0
Newfoundland	..	..	..	..	..	..	..	..	..	..	45.2	100.0
Québec	1.1	19.0	0.2	3.4	4.6	79.3	0.0	0.0	0.0	0.0	5.8	100.0
Manitoba	0.1	14.3	0.5	71.4	0.1	14.3	0.0	0.0	0.0	0.0	0.7	100.0
Alberta	0.0	0.0	0.9	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	100.0
Northwest Territories	2.6	10.0	22.1	85.0	1.2	4.6	0.0	0.0	0.0	0.0	26.0	100.0
Hudson Bay Plain	0.7	11.3	1.8	29.0	1.5	24.2	2.3	37.1	0.0	0.0	6.2	100.0
Québec	0.6	28.6	0.3	14.3	1.2	57.1	0.0	0.0	0.0	0.0	2.1	100.0
Ontario	0.1	2.4	1.5	36.6	0.3	7.3	2.3	56.1	0.0	0.0	4.1	100.0
Southern Arctic	0.1	3.1	0.2	6.3	2.6	81.3	0.0	0.0	0.0	0.0	3.2	100.0
Newfoundland	..	..	..	..	..	..	..	..	..	..	0.4	100.0
Northwest Territories	0.1	3.6	0.2	7.1	2.6	92.9	0.0	0.0	0.0	0.0	2.8	100.0
Canada	159.2	8.4	850.5	44.7	684.9	36.0	62.4	3.3	4.7	0.2	1 903.0	100.0

¹ See Technical Box 3.2.1 for definition of age classes.

² Age class has only been determined for stocked, productive, non-reserved forestland.

Source:

Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch, *Canada's Forest Inventory, 1981*.

Note:

Individual items may not add to totals due to rounding.

Table 3.2.7
Volume of Softwood Species on Stocked, Productive Forestland,¹ by Ecozone, 1981

Ecozone	Spruce	Pine	Fir	Hemlock	Cedar	Douglas Fir	Other ²	Softwood Total
thousands of cubic metres								
Atlantic Maritime	254 921	32 406	220 725	13 929	45 232	0	5 637	572 851
Nova Scotia	76 050	12 282	38 082	7 876	0	0	2 573	136 862
Prince Edward Island	..	..	..	..	..	..	..	..
New Brunswick	153 260	19 851	117 073	6 053	37 139	0	2 750	336 126
Québec	25 612	273	65 570	0	8 093	0	314	99 863
Mixed-Wood Plain	20 249	4 246	42 015	6 338	9 755	0	967	83 570
Québec	18 507	2 436	41 018	6 156	7 207	0	879	76 202
Ontario	1 742	1 810	997	182	2 548	0	88	7 368
Boreal Shield	3 248 056	920 187	1 065 813	29 964	100 414	0	71 736	5 436 170
Newfoundland	39 246	261	43 368	0	0	0	46 230	129 106
New Brunswick	405	96	778	1	178	0	0	1 457
Québec	1 701 151	221 823	862 697	18 910	54 682	0	8 402	2 867 665
Ontario	1 257 601	545 236	152 872	11 054	44 969	0	11 328	2 023 060
Manitoba	196 116	124 906	5 440	0	585	0	5 404	332 451
Saskatchewan	53 536	27 866	657	0	0	0	372	82 431
Prairie	4 879	3 176	168	0	0	160	284	8 667
Manitoba	4 643	2 456	117	0	0	0	281	7 497
Saskatchewan	98	127	7	0	0	0	3	235
Alberta	138	593	44	0	0	160	0	935
Boreal Plain	746 244	495 822	38 772	0	129	6 261	105 309	1 392 538
Manitoba	55 851	33 556	4 030	0	129	0	3 200	96 765
Saskatchewan	120 539	82 156	4 312	0	0	0	3 664	210 671
Alberta	337 404	282 639	26 413	0	0	6 152	106	652 714
British Columbia	232 450	97 472	4 017	0	0	110	736	334 784
Yukon	0	0	0	0	0	0	93 097	93 097
Northwest Territories	0	0	0	0	0	0	4 506	4 506
Montane Cordillera	1 223 841	1 386 581	810 396	224 871	146 498	447 665	51 510	4 291 362
Alberta	35 263	54 586	4 742	0	0	2 594	19	97 204
British Columbia	1 188 579	1 331 995	805 654	224 871	146 498	445 070	51 491	4 194 158
Pacific Maritime	152 568	34 762	369 888	909 170	454 656	154 284	113 302	2 188 631
British Columbia	152 568	34 762	369 888	909 170	454 656	154 284	113 302	2 188 631
Boreal Cordillera	314 449	146 430	123 855	6 226	0	19	81 173	672 152
British Columbia	314 449	146 430	123 855	6 226	0	19	140	591 119
Yukon	0	0	0	0	0	0	81 033	81 033
Tundra Cordillera	0	0	0	0	0	0	72 062	72 062
Yukon	0	0	0	0	0	0	40 097	40 097
Northwest Territories	0	0	0	0	0	0	31 966	31 966
Taiga Plain	52 366	4 449	10 477	0	0	3	241 402	308 698
Alberta	21 215	2 721	1 927	0	0	0	0	25 863
British Columbia	31 151	1 728	8 550	0	0	3	761	42 194
Northwest Territories	0	0	0	0	0	0	240 641	240 641
Taiga Shield	30 704	4 147	9 160	0	0	0	274 437	318 449
Newfoundland	6 578	0	3 543	0	0	0	249 474	259 595
Québec	22 943	249	5 611	0	0	0	160	28 963
Manitoba	756	26	0	0	0	0	1	782
Alberta	428	3 873	6	0	0	0	0	4 306
Northwest Territories	0	0	0	0	0	0	24 803	24 803
Hudson Bay Plain	35 465	2 961	818	0	87	0	503	39 834
Québec	11 129	1 239	349	0	2	0	32	12 751
Ontario	24 336	1 722	468	0	85	0	471	27 083
Southern Arctic	0	0	0	0	0	0	11 669	11 669
Newfoundland	0	0	0	0	0	0	1 606	1 606
Northwest Territories	0	0	0	0	0	0	10 062	10 062
Canada	6 083 742	3 035 167	2 692 083	1 190 498	756 771	608 392	1 029 942	15 396 653

¹ Volume of wood on stocked, productive, non-reserved forestland only. See Technical Box 3.2.1 for definitions.

² Tamarack, western larch, European larch.

Source:

Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch, *Canada's Forest Inventory, 1981*.

Notes:

The minor differences between the Canada and Provincial totals here and those in *Canada's Forest Inventory, 1981* are due to the reaggregation of the data to ecozones. Also, individual items may not add to totals due to rounding.

Table 3.2.8
Volume of Hardwood Species on Stocked, Productive Forestland,¹ by Ecozone, 1981

Ecozone	Aspen/Poplar	Birch	Maple	Other ²	Hardwood Total	All Hardwood and Softwood Species Total
thousands of cubic metres						
Atlantic Maritime	48 762	56 112	118 825	46 321	270 021	842 873
Nova Scotia	6 453	0	36 913	22 236	65 601	202 463
Prince Edward Island	..	..	..	..	..	..
New Brunswick	32 373	46 031	76 035	23 530	177 969	514 095
Québec	9 937	10 081	5 877	556	26 451	126 314
Red-Wood Plain	16 270	28 000	67 570	16 870	128 711	212 281
Québec	12 898	26 351	63 954	13 784	116 986	193 188
Ontario	3 373	1 650	3 617	3 086	11 725	19 093
Boreal Shield	936 588	804 065	296 832	93 934	2 131 419	7 567 587
Newfoundland	1 719	13 048	259	4 534	19 560	148 666
New Brunswick	56	127	166	21	370	1 827
Québec	231 065	444 579	164 492	55 345	895 481	3 763 146
Ontario	596 422	329 539	131 916	33 489	1 091 367	3 114 427
Manitoba	86 595	12 318	0	544	99 458	431 909
Saskatchewan	20 729	4 454	0	0	25 183	107 613
Prairie	15 636	804	0	1 930	18 371	27 038
Manitoba	14 762	778	0	1 930	17 470	24 967
Saskatchewan	457	26	0	0	484	719
Alberta	417	0	0	0	417	1 352
Boreal Plain	986 283	26 460	817	17 707	1 031 268	2 423 806
Manitoba	69 526	5 857	0	2 752	78 136	174 901
Saskatchewan	154 210	9 148	817	652	164 828	375 500
Alberta	606 118	0	0	0	606 118	1 258 832
British Columbia	156 428	11 454	0	0	167 882	502 666
Yukon	0	0	0	9 876	9 876	102 973
Northwest Territories	0	0	0	4 427	4 427	8 933
Montane						
Cordillera	124 077	21 891	298	455	146 720	4 438 083
Alberta	14 003	0	0	0	14 003	111 207
British Columbia	110 073	21 891	298	455	132 717	4 326 875
Pacific Maritime	16 385	3 299	4 426	19 699	43 809	2 232 440
British Columbia	16 385	3 299	4 426	19 699	43 809	2 232 440
Boreal Cordillera	38 346	2 299	0	18 140	58 785	730 937
British Columbia	38 346	2 299	0	0	40 645	631 764
Yukon	0	0	0	18 140	18 140	99 173
Indra Cordillera	0	0	0	17 279	17 279	89 341
Yukon	0	0	0	11 852	11 852	51 748
Northwest Territories	0	0	0	5 428	5 428	37 393
Alga Plain	50 977	1 960	0	113 787	166 725	475 423
Alberta	35 414	0	0	0	35 414	61 277
British Columbia	15 563	1 960	0	0	17 524	59 717
Northwest Territories	0	0	0	113 787	113 787	354 428
Alga Shield	1 201	1 460	0	16 285	18 946	337 396
Newfoundland	72	714	0	9 234	10 020	269 615
Québec	101	733	0	0	834	29 797
Manitoba	10	12	0	0	22	805
Alberta	1 018	0	0	0	1 018	5 324
Northwest Territories	0	0	0	7 052	7 052	31 854
Arctic Bay						
Yukon	3 053	618	0	0	3 671	43 505
Québec	682	126	0	0	808	13 559
Ontario	2 371	492	0	0	2 864	29 946
Southern Arctic	0	0	0	50	50	11 719
Newfoundland	0	0	0	34	34	1 641
Northwest Territories	0	0	0	16	16	10 078
Canada	2 237 578	946 968	488 589	362 457	4 035 775	19 432 327

¹Volume of wood on stocked, productive, non-reserved forestland only. See Technical Box 3.2.1 for definitions.

²Black willow, butternut, black walnut, hickory, alder, beech, oak, elm, ash, red mulberry, tulip tree, sassafras, black cherry, cascara, basswood, black gum, arbutus.

Source:

Environment Canada, Canadian Forestry Service, Forestry Statistics and Systems Branch, *Canada's Forest Inventory, 1981*.

Notes:

The minor differences between the Canada and Provincial totals here and those in *Canada's Forest Inventory, 1981* are due to the re-aggregation of the data to ecozones. Also, individual items may not add to totals due to rounding.

Table 3.2.9
Forest Harvest¹ by Province, 1954 to 1982 (5 year averages)

Province	1954 to 1958		1959 to 1963		1964 to 1968		1969 to 1973		1974 to 1978		1979 to 1982 ²		Percentage Change Between Periods 1954-1958 and 1979-1982
	Volume	Volume as a Percentage of Canada Total	Volume	Volume as a Percentage of Canada Total	Volume	Volume as a Percentage of Canada Total	Volume	Volume as a Percentage of Canada Total	Volume	Volume as a Percentage of Canada Total	Volume	Volume as a Percentage of Canada Total	
	000s of cubic metres	percent	000s of cubic metres	percent	000s of cubic metres	percent	000s of cubic metres	percent	000s of cubic metres	percent	000s of cubic metres	percent	percent
Newfoundland	2 825	3.1	2 747	2.9	2 638	2.5	2 567	2.0	2 498	1.8	2 556	1.7	-11
Prince Edward Island	285	0.3	244	0.3	176	0.2	201	0.2	164	0.1	278	0.2	-3
Nova Scotia	2 941	3.3	2 565	2.8	3 142	2.9	3 349	2.7	3 765	2.7	3 980	2.7	26
New Brunswick	5 726	6.4	5 052	5.4	5 920	5.5	7 301	5.8	7 875	5.7	7 813	5.3	27
Québec	27 097	30.1	25 263	27.1	27 456	25.6	28 535	22.6	31 064	22.4	32 698	22.2	17
Ontario	14 924	16.6	14 846	15.9	16 627	15.5	17 210	13.6	17 857	12.9	21 301	14.5	30
Manitoba	1 679	1.9	1 299	1.4	1 135	1.1	1 595	1.3	1 890	1.4	1 885	1.3	11
Saskatchewan	1 560	1.7	1 294	1.4	1 474	1.4	2 470	2.0	2 756	2.0	3 248	2.2	52
Alberta	3 222	3.6	3 778	4.1	3 530	3.3	4 580	3.6	5 708	4.1	6 110	4.2	47
British Columbia	29 609	32.9	36 003	38.6	44 883	41.9	58 277	46.2	64 964	46.8	66 965	45.6	56
Yukon and Northwest Territories	136	0.2	104	0.1	102	8.1	99	0.1	155	0.1	153	0.1	11
Canada	90 005	100.0	93 196	100.0	107 081	100.0	126 186	100.0	138 695	100.0	146 985	100.0	39

¹ Data on forest harvest are obtained from a survey of the logging industry by "establishment" (an accounting unit for the purpose of collecting principal statistics). The geographical location of the data is by address of establishment rather than location of harvesting activity.

² The 1979 to 1982 average is based on a four year period.

Source:

Statistics Canada, Manufacturing and Primary Industries Division, *Canadian Forestry Statistics*, various issues, Catalogue No. 25-202.

Note:

Individual items may not add to totals due to rounding.

Table 3.2.10
Annual Forest Harvest, Site Preparation¹ and Planting (based on a 5 year average, 1976 to 1980)

Province	Area Harvested ²	Site Preparation		Planting		Direct Seeding	
		Area	Area as a Percentage of Area Harvested	Area	Area as a Percentage of Area Harvested	Area	Area as a Percentage of Area Harvested
	square kilometres	square kilometres	percent	square kilometres	percent	square kilometres	percent
Newfoundland	(160) ²	4	2.5	--	--	0	0.0
Prince Edward Island	16	1	6.2	1	6.2	0	0.0
Nova Scotia	295	14	4.7	22	7.4	--	--
New Brunswick	(926)	139	15.0	101	10.9	2	0.1
Québec	1 956	75	3.8	152	7.8	47	2.4
Ontario	1 910	469	24.5	282	14.8	254	13.3
Manitoba	(191)	42	21.9	10	5.2	7	3.6
Saskatchewan	146	50	34.2	53	36.3	0	0.0
Alberta	215	166	77.2	63	29.3	64	29.7
British Columbia	1 766	699	39.6	602	34.1	0	0.0
Yukon	6	--	--	0	0.0	0	0.0
Northwest Territories	6	0	0.0	0	0.0	0	0.0
Canada	7 594	1 659	21.8	1 287	16.9	374	4.9

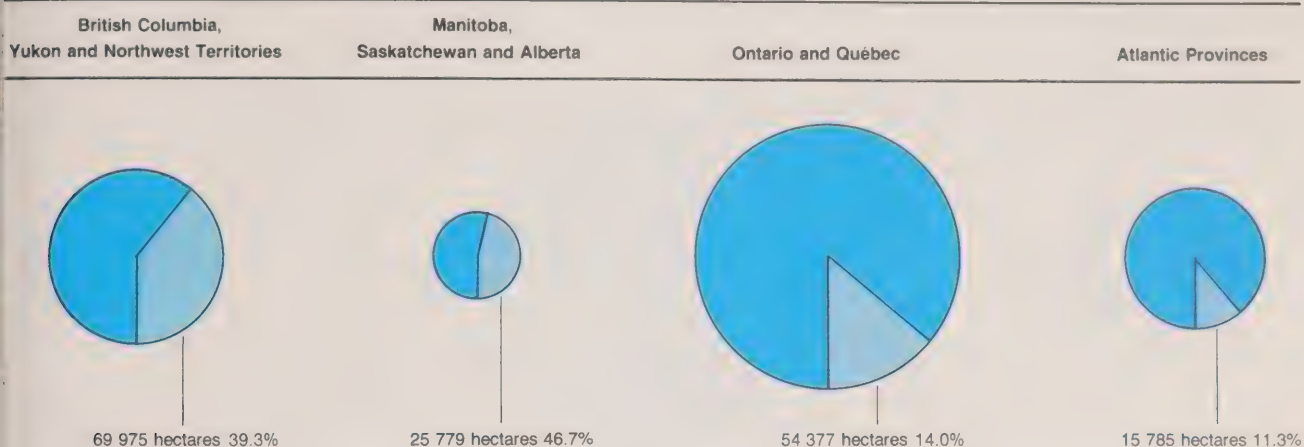
¹ Site preparation is mainly the breaking of ground and burning of wood debris.

² Numbers in brackets are estimates by the Canadian Forestry Service.

Source:

Environment Canada, Northern Forest Research Centre, Canadian Forestry Service, *Silviculture Statistics for Canada, 1975-1980, 1982*.

Chart 3.2.11
Area of Site Preparation¹ as a Proportion of Area Harvested
 (five year annual average, 1976 to 1980)



¹Site preparation refers to working of top soil and burning of debris.

Source: Environment Canada, Canadian Forestry Service, *Silviculture Statistics for Canada 1975-80, 1982*.



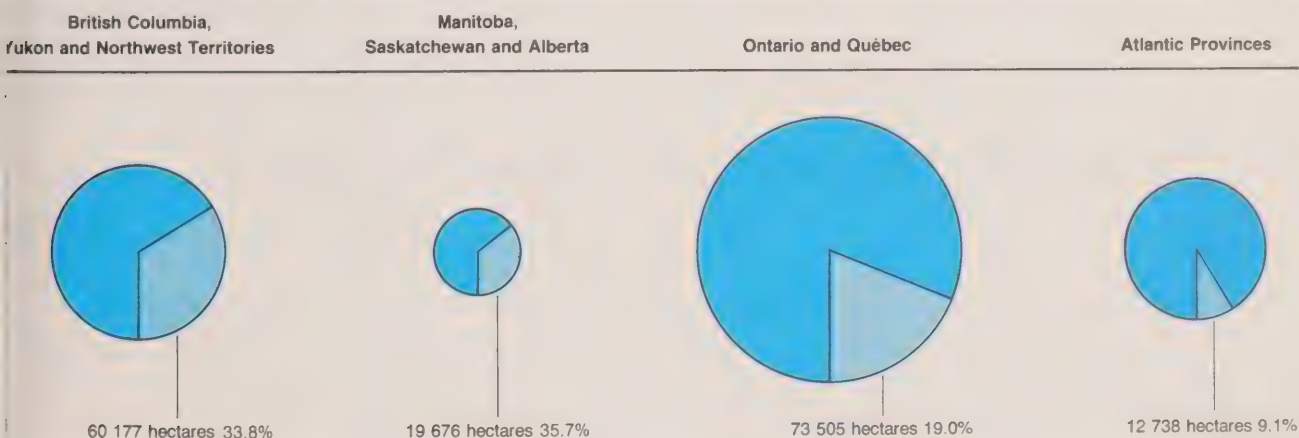


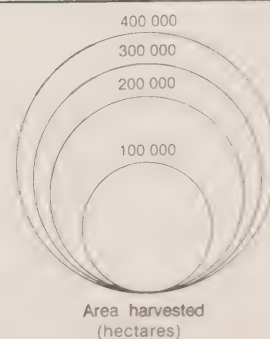
 Area harvested and not prepared¹
 Area of site preparation

Chart 3.2.12
Area of Planting and Seeding as a Proportion of Area Harvested
 (five year annual average, 1976 to 1980)



 Area harvested and not replanted
 Area of planting and seeding

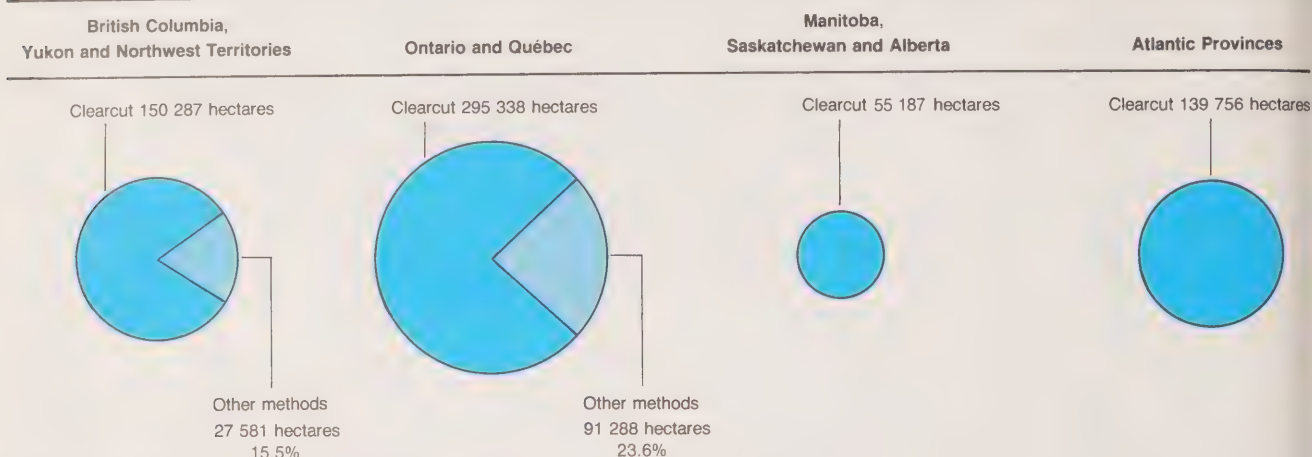


Source: Environment Canada, Canadian Forestry Service, *Silviculture Statistics for Canada, 1975-80, 1982*.

Chart 3.2.13

Method of Forest Harvest by Region

(based on a five year average, 1976 to 1980)



¹ Clearcutting is a method of harvesting in which all merchantable timber is cut within a particular area.

² Other methods of harvesting include strip cutting (cutting of forest in bands), selective cutting (selection and cutting of specific species), and seed tree cutting (cutting of trees left for seeding in an area that was previously harvested).

Source:

Environment Canada, Canadian Forestry Service, *Silviculture Statistics for Canada 1975-80, 1982.*

Area clearcut¹
Area harvested by other methods²

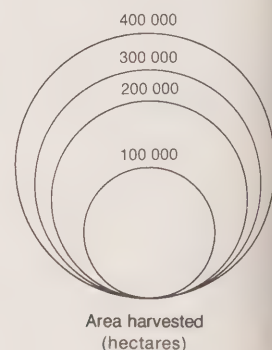


Table 3.2.14

Area of Pest Control on Forestland¹ (based on a 5 year average, 1976 to 1980)

Province	Area of Pest Control	Stocked Productive Forestland	Proportion of Stocked Productive Forest with Pest Control
	square kilometres		percent
Newfoundland	919	79 790	1.2
Nova Scotia	114	28 770	0.4
Prince Edward Island	0	2 480	0
New Brunswick	22 820	59 120	38.6
Québec	17 800	489 290	3.6
Ontario	1 851	339 330	0.6
Manitoba	0	121 060	0
Saskatchewan	0	82 380	0
Alberta	0	149 900	0
British Columbia	24	420 340	--
Northwest Territories and Yukon	0	192 270	0
Canada	43 528	1 964 730	2.2

¹ Refers to inventoried, stocked, productive forestland. See Technical Box 3.2.1 for definitions.

Source:

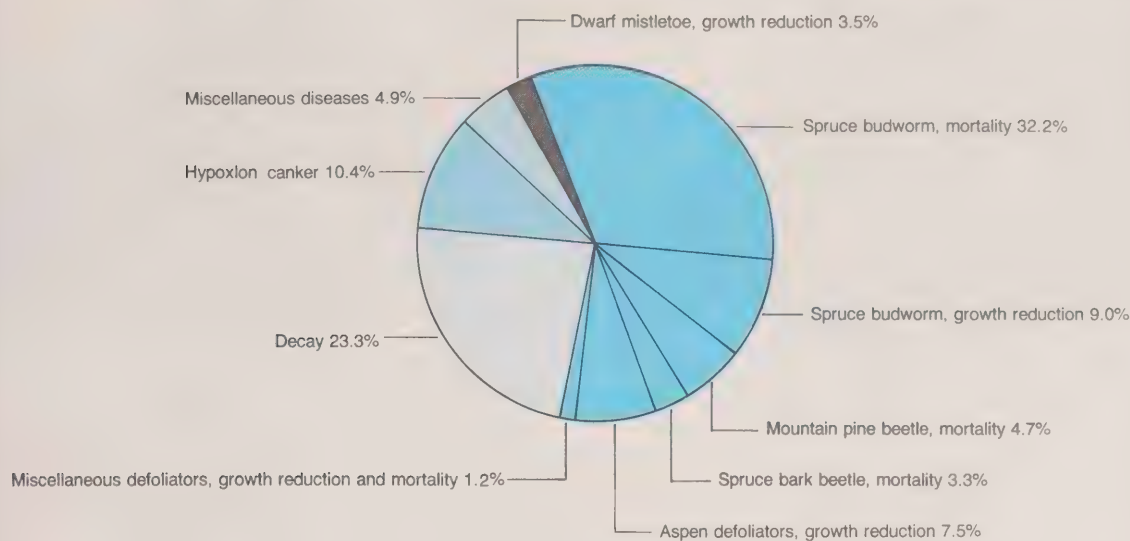
Environment Canada, Canadian Forestry Service, *Canada's Forest Inventory, 1981.*

Environment Canada, Canadian Forestry Service, *Silvicultural Statistics for Canada, 1975-1980, 1982.*

Notes:

There were two major kinds of pest control activities during this period. British Columbia mainly carried out mistletoe control using mechanical methods, while other provinces focussed their activities on spruce budworm spraying.

Chart 3.2.15
Estimated Forest Loss From Insects and Disease
 (Five year annual average, 1977 to 1981)



Note:
 Average annual loss of forest over the 5 year period amounted to 107.4 million cubic metres or roughly 73.1 percent of the 1982 harvest of 147 million cubic metres.

Spruce budworm - a shoot and bud tunnelling worm
 Mountain pine beetle - a bark and wood boring beetle
 Spruce bark beetle - a bark and wood boring beetle
 Aspen defoliators - various caterpillar species
 Decay - micro-organisms which consume bark and wood
 Hypoxylon canker - a growth impeding disease
 Dwarf mistletoe - a parasitic plant

Source:
 Environment Canada, Canadian Forestry Service, *Forest Insect and Disease Conditions in Canada, 1981*, Ottawa, 1982.

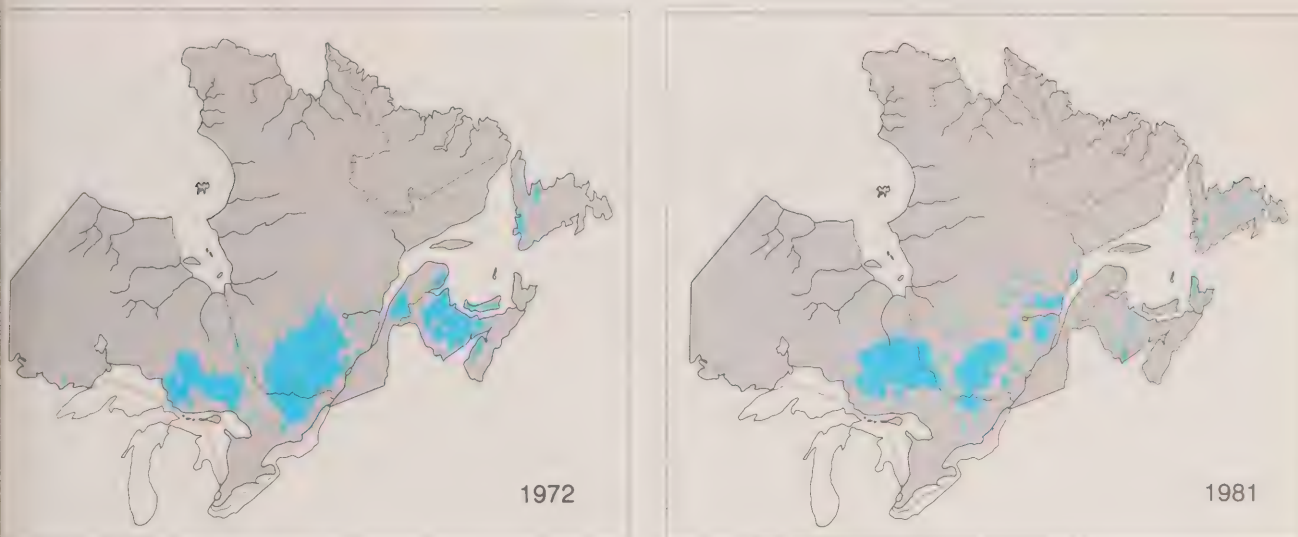
Map 3.2.16
Spread of Dutch Elm Disease in Canada, 1945 to 1982



Sources:
Environment Canada, Canadian Forestry Service, *Forest Insect and Disease Conditions in Canada, 1982*.

Map 3.2.17

Spruce Budworm Defoliation in Eastern Canada, 1972 and 1981



Source: Environment Canada, Canadian Forestry Service, *A Cartographic History of Spruce Budworm Defoliation, 1967 to 1981, in Eastern Canada*, 1983.

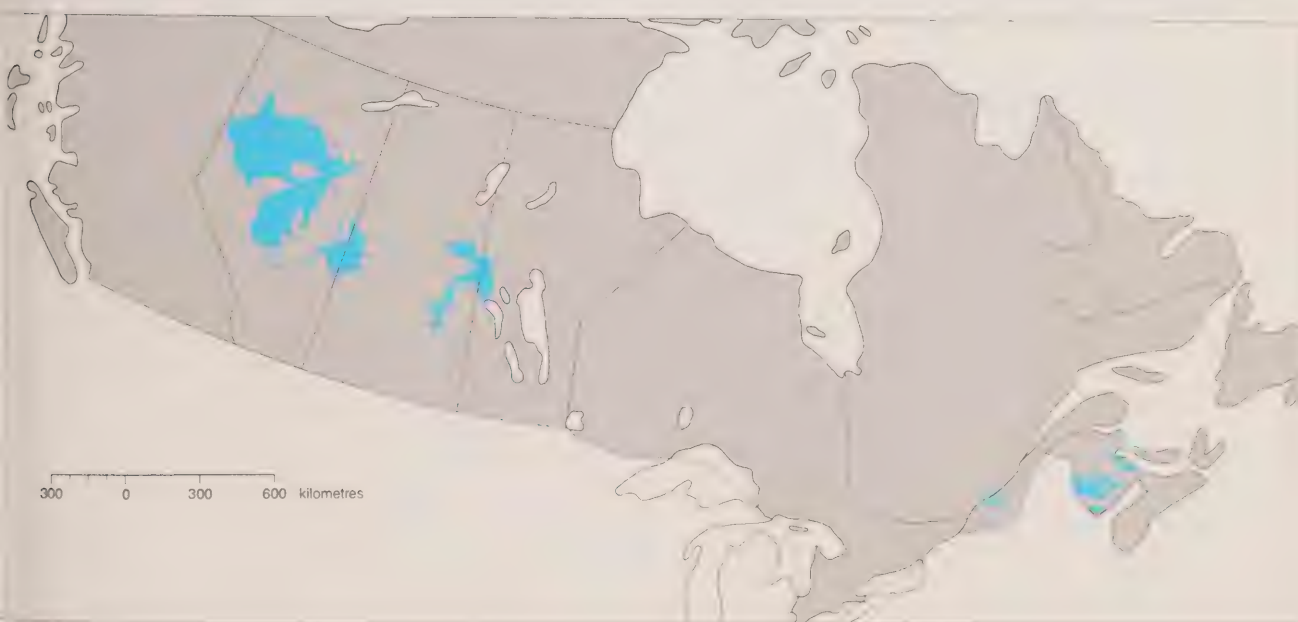
Note: The primary hosts for spruce budworm are balsam fir, white, red, and black spruce. Outbreaks of this pest are natural phenomena associated with spruce-fir forests.

Area of defoliation

370 0 370 740 kilometres

Map 3.2.18

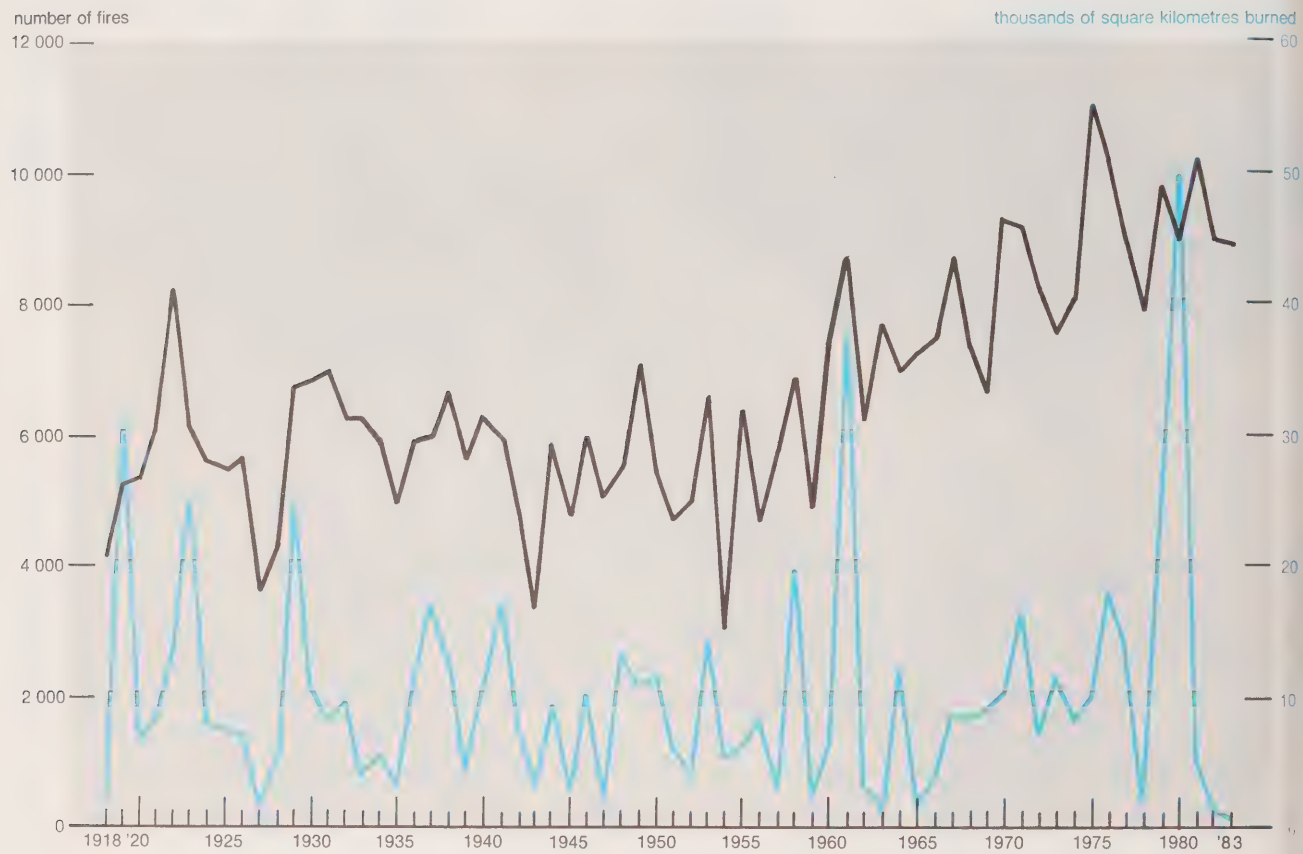
Tent Caterpillar Defoliation in Canada, 1982



Source: Environment Canada, Canadian Forestry Service, *Forest Insect and Disease Conditions in Canada*, 1982.

Area of tent caterpillar defoliation

Chart 3.2.19
Number of Forest Fires and Area Burned, 1918 to 1983



Source:
Agriculture Canada, Canadian Forestry Service, Petawawa Forest Experimenta-
tion Station, 1985.

— Number of fires
— Thousands of square kilometres burned

Chart 3.2.20
Number of Forest Fires by Cause

(ten year annual average, 1973-1982)

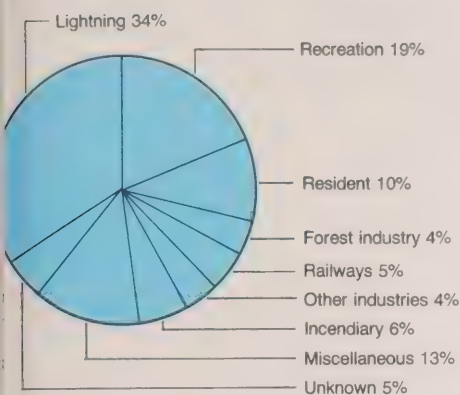
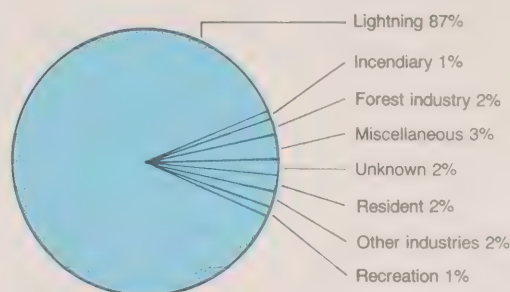


Chart 3.2.21
Area Burned by Forest Fires by Cause

(ten year annual average, 1973-1982)



Source: Agriculture Canada, Canadian Forestry Service, Petawawa Forest Experiment Station, 1985.

Note: Recreation - applies to fires caused by people engaged in any recreational activity.
Resident - applies to fires resulting from activity associated with people living in forested or partly forested area, including agriculture.
Forest industry - applies to fires caused by men or machines involved in forestry.

Railways - applies to fires caused by any machine, employee, or contractor with railroad operations or any passengers riding on a train.

Other industry - applies to fires caused by any industrial activity other than the forest industry or railroads.

Incendiary - applies to fires started willfully for the purpose of mischief, grudge or gain.

Miscellaneous - applies to any fire whose cause is known but does not fit any of the preceding.

Unknown - applies to fires of undeterminable cause.

Table 3.2.22

Socio - Economic Profile of Persons Employed in the Forestry and Logging Industry¹ by Ecozone, 1981

Ecozone	Total Employed ²		Full Time Employed ³						
	Persons	Average Income	Persons	Percentage of Total Employed	Average Income	Self Employed ⁴	45 years and Over	Education Level	
								Less than Grade Nine	Post Secondary
		dollars		percent	dollars		percent		
Atlantic Maritime	20 130	8 400	8 180	41	13 400	14	27	36	26
Prince Edward Island	330	6 000	145	44	9 800	17	3	13	47
Nova Scotia	4 895	8 800	2 900	59	12 400	15	27	34	24
New Brunswick	9 975	8 000	3 805	38	13 800	16	27	40	27
Québec	4 935	9 000	1 335	27	15 200	7	28	34	21
Mixed-Wood Plain	11 035	10 200	5 815	53	14 700	15	31	38	28
Québec	7 315	10 600	3 905	53	14 400	16	30	46	21
Ontario	3 720	9 400	1 915	51	15 500	14	33	20	45
Boreal Shield	30 870	13 600	19 325	63	18 100	10	28	37	22
Newfoundland	4 010	9 400	2 115	53	13 500	7	30	48	16
Québec	14 255	13 300	8 560	60	17 300	8	26	39	17
Ontario	11 865	15 500	8 295	70	20 000	12	29	31	29
Manitoba	525	11 900	255	49	19 500	11	30	52	10
Saskatchewan	220	9 300	90	41	16 600	11	28	33	22
Prairie	1 815	11 000	1 070	59	15 600	12	23	12	46
Manitoba	475	10 400	280	59	14 600	14	27	16	34
Saskatchewan	270	12 300	160	59	17 500	10	20	16	58
Alberta	1 075	10 900	635	59	15 600	12	26	10	48
Boreal Plain	5 485	13 900	3 510	64	18 500	14	21	24	37
Manitoba	800	8 800	360	45	14 600	15	23	41	25
Saskatchewan	1 150	14 500	710	62	18 900	17	26	27	33
Alberta	3 065	14 800	2 140	70	19 300	13	18	20	40
British Columbia	460	14 700	295	64	16 700	14	21	23	39
Montane Cordillera	14 345	18 300	10 780	75	21 500	19	26	20	30
Alberta	150	13 800	105	70	17 800	14	10	10	50
British Columbia	14 205	18 300	10 675	75	21 500	19	26	20	30
Pacific Maritime	24 700	20 700	19 390	79	23 900	7	29	15	36
British Columbia	24 700	20 700	19 390	79	23 900	7	29	15	36
Boreal Cordillera	180	14 800	110	61	18 800	14	9	24	38
British Columbia	90	17 000	60	67	20 900	33	..	..	..
Yukon	95	12 600	50	53	16 200	..	..	..	40
Taiga Plain	165	7 400	40	24	18 000	19	9	..	..
Northwest Territories	95	8 800	35	37	17 300	19	9	..	..
Taiga Shield	130	7 800	45	35	16 600	..	..	..	..
Newfoundland	90	6 600	25	28	16 500	..	..	..	..
Hudson Bay Plain	100	4 100	20	20	10 600	..	..	..	..
Ontario	80	3 900	15	19	12 100	..	..	..	..

¹ Standard industrial classification categories 031-039: logging and forestry services.² Employed in 1980.³ Employed 27 or more weeks in 1980.⁴ Self employed persons are full-time workers who are not wage-earners or unpaid family workers.**Source:**

Statistics Canada, 1981 Census of Population, special tabulations.

3.3

Fisheries



Technical Box 3.3.1

Fish Catch: an Indicator of Fish Stock

The management of fishing resources on a sustainable yield basis requires knowledge of fish stocks. Scientists are continuing to refine their estimation techniques by applying a combination of catch statistics, data on units of fishing effort (i.e. time/energy/equipment used to catch fish), biological sampling of fish landings for size and age, and direct sampling of fish populations by research survey vessels. These data, with the aid of models, provide the basis for fish population estimates by species and their geographic distributions. With current knowledge of the geographic distribution and dynamics of fish populations, it is possible to estimate stocks with well-defined feeding and breeding behavior. Many pelagic stocks (see definitions) are subject to unknown factors and thus estimates are less reliable.

A measure of historical trends and the assessment of the current state of stocks can be obtained from catch statistics. During the 1960s, the relationship between stock and catch in the Northwest Atlantic and Northeast Pacific began to trouble fish biologists. Their concern centred on the potential collapse of certain "over-fished" stocks, caused in part by the influx of foreign fishing fleets. This was made worse by the introduction of more efficient harvesting technology (for example, sonar detection devices, more powerful vessels and more efficient gear). Fisheries management responded to the high pressure on stocks (and the subsequent decline of "over-fished" stocks) by introducing more stringent controls on fishing activities. These controls were further expanded with the promulgation of the 200 nautical mile limit of Canada's fisheries jurisdiction in 1977 (See Maps 3.3.2 and 3.3.12).

Stocks are now managed by establishing total allowable catch for most species in designated management zones. The annual harvest quotas are based both on biological (i.e. sustainable yield) and socio-economic criteria (i.e. viability of the fishing industry). It should be noted that naturally occurring environmental changes (for example, changes in ocean currents) are for many species at least as important as fishing in determining long-term population fluctuations. It is believed that fishing pressure can accentuate or depress natural fluctuations and delay recoveries of stock.

Data presented in this section show trends in catch of major fish species by commercial fishermen. Abrupt changes in trends are usually footnoted to place them in context with changes in human activities (for example, technological changes, new fleet entries, or regulations).

Definitions and Concepts

Groundfish is a collective term to describe species that feed near the ocean bottom. These fish, for the most part, are caught by trawlers using a net that is towed along the ocean floor scooping up the fish. Principal species caught are cod, haddock, rockfish, flounders and sole, turbot, pollock, hake, halibut and skate.

Pelagic species are fish that swim near the surface often in large schools. They are usually captured using the purse seine method; the fishing boat circles the school with a seine net and the bottom is drawn up, trapping the fish. Principal pelagic species are herring, mackerel, capelin, and tuna.

Anadromous fish spend their adult life at sea and migrate to the streams and lakes in which they hatched to spawn. Principal commercial species are salmon, alewife and smelt. Salmon are caught by purse seines, hook and line and gill nets (floating nets).

Invertebrates (shellfish) On the Atlantic, the main species caught are lobsters, scallops, shrimps, crabs, oysters, squids and clams. On the Pacific, the important species are now geoducks, oysters, crabs, clams, shrimp, and abalone.

Catch All data presented are the weight of fish and shellfish brought ashore by fishermen. This is live weight, or if fish are processed at sea, live weight equivalent (nominal catch).

Two Hundred Mile Limit As of January 1, 1977, the area under Canadian jurisdiction was extended to 200 nautical miles on both coasts. This action was taken to ensure conservation and management of marine resources. It conformed with the consensus of the Law of the Sea Conference.

Total Allowable Catch For each distinct stock of fish, an annual forecast of the permissible catch level is made by biologists to ensure stability of the population and to rebuild the stock if it has been depleted.

Quota Catch limits are issued by the Department of Fisheries and Oceans based on the total allowable catch for each stock, by management zone, and by fleet (domestic and foreign).

Fishery This term refers to the industry of catching, processing and marketing fish but it may also be used to define a fishing ground or the legal jurisdiction to catch fish in specified waters.

Catch Statistics

All catch statistics are shown in metric tons (1 000 kilograms).

3.3.2 Northwest Atlantic Fisheries Management Zones



The Northwest Atlantic Fisheries Organization is an international commission that maintains fisheries records, defines fishing areas and coordinates research in the Atlantic fishery.

Depths less than 100 fathoms (200 metres) roughly define principal fishing areas utilized by domestic and foreign fleets. Productivity of marine life is promoted along the edges of the continental shelf by the upwelling of nutrients from deep water.

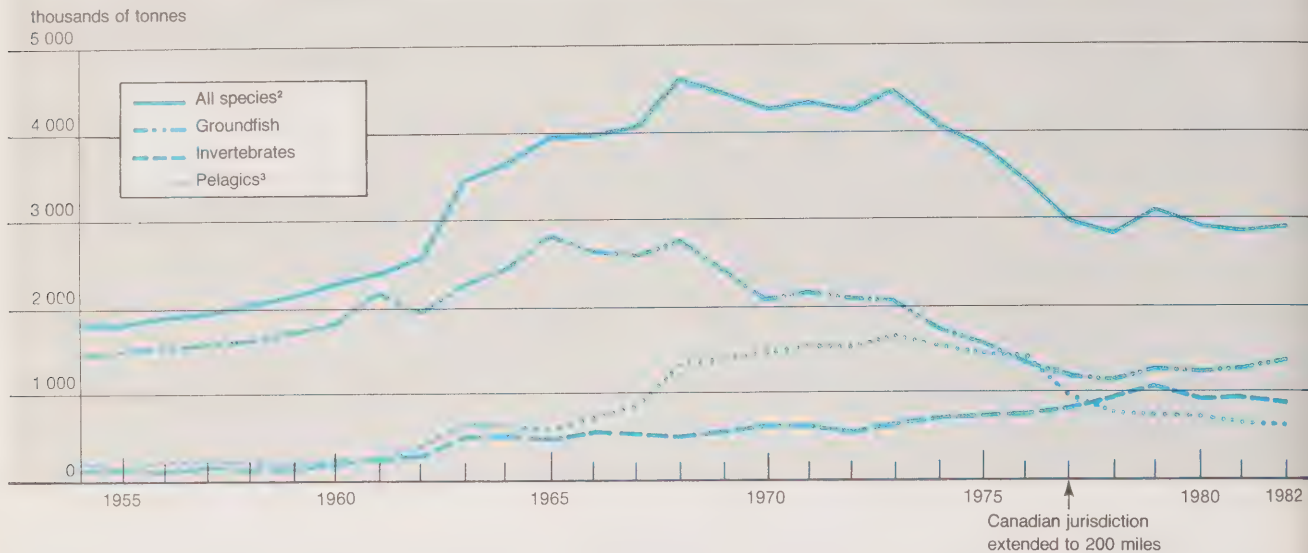
In January 1, 1977, Canada extended its fisheries jurisdiction to 200 nautical miles, becoming "owner and manager" of all fisheries within 200 miles of its coasts. Ninety percent of Atlantic fish stocks are concentrated on fishing banks within the zone.

In October 12, 1984, a new boundary was drawn by the International Court of Justice, dividing both the fishing zones and the continental shelf in the Gulf of Maine area. The case centred on a dispute between Canada and the U.S. over the rich fishing resources and potential hydrocarbon deposits of the Georges Bank.

Source:

Department of Fisheries and Oceans, Fish Management Branch, *Canadian Atlantic Offshore Fisheries Atlas*, edited by D.J. Scarrett, Ottawa, 1982.

Chart 3.3.3

Catch¹ by Species Groups in the Northwest Atlantic, 1954 to 1982

¹ Includes catch by Canadian and foreign vessels.

² Includes seaweeds.

³ Catch of Atlantic salmon and incidental catch of other species are also included with the pelagics.

Sources:

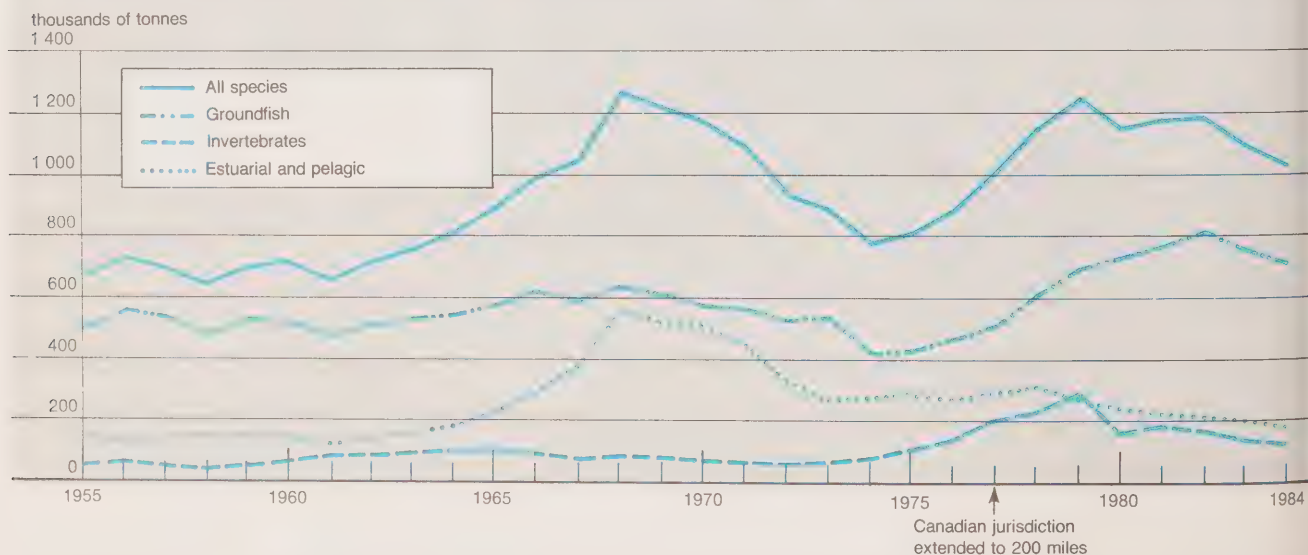
International Commission for the Northwest Atlantic Fisheries, *Statistical Bulletins*, Volumes 4 to 28, Dartmouth, years 1956 to 1980 (annual).

Northwest Atlantic Fisheries Organization, *Statistical Bulletins*, Volumes 29 to 32, Dartmouth, years 1981 to 1984 (annual).

Note:

Rising catches in the 1960s were mainly due to increased foreign effort; the decline in the 1970s was due to the introduction of regulations brought in as a response to overfishing.

Chart 3.3.4

Canadian Catch¹ by Species Groups in the Northwest Atlantic, 1955 to 1984²

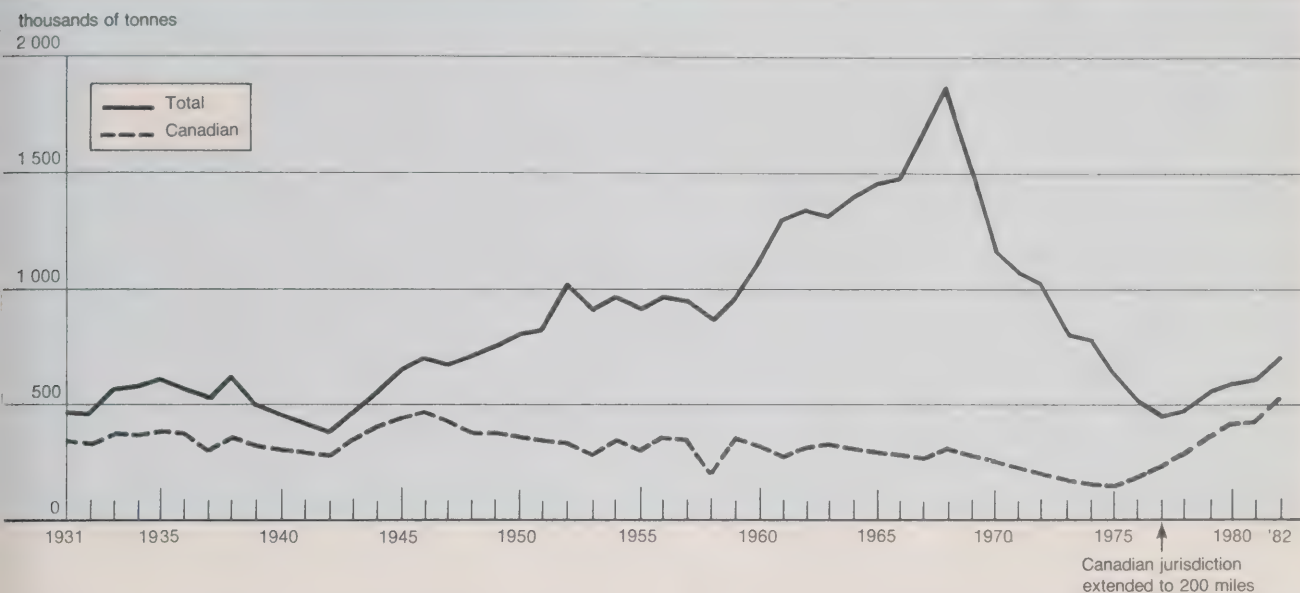
¹ Refers to fish landed in Canadian ports. Since 1978, under cooperative arrangements, foreign vessels have landed small quantities of groundfish (mainly cod) and squid in Atlantic ports.

² Figures for 1984 are preliminary.

Source:

Department of Fisheries and Oceans, Economic Development Directorate, *Annual Statistical Review of Canadian Fisheries*, Volumes 9 to 15, Ottawa, years 1977 to 1984.

Chart 3.3.5
Catch¹ of Atlantic Cod in the Northwest Atlantic, 1931 to 1982

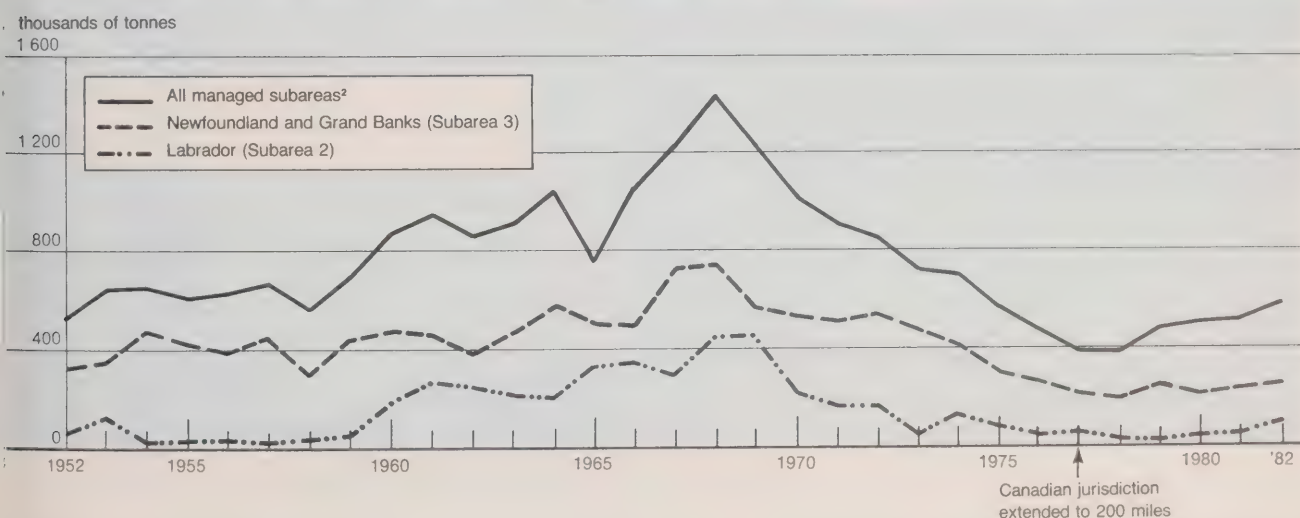


Participating in this fishery in addition to Canada, are the United States of America, the Soviet Union and many European nations. The Soviet Union and Eastern European countries first reported cod catches in 1956 although earlier activity may have taken place.

Sources:

International Commission for the Northwest Atlantic Fisheries, *Statistical Bulletins*, Volumes 1 to 28, Dartmouth, years 1953 to 1980 (annual).
Northwest Atlantic Fisheries Organization, *Statistical Bulletins*, Volumes 29 to 32, Dartmouth, years 1981 to 1984 (annual).

Chart 3.3.6
Catch of Atlantic Cod on the Canadian Continental Shelf¹, 1952 to 1982



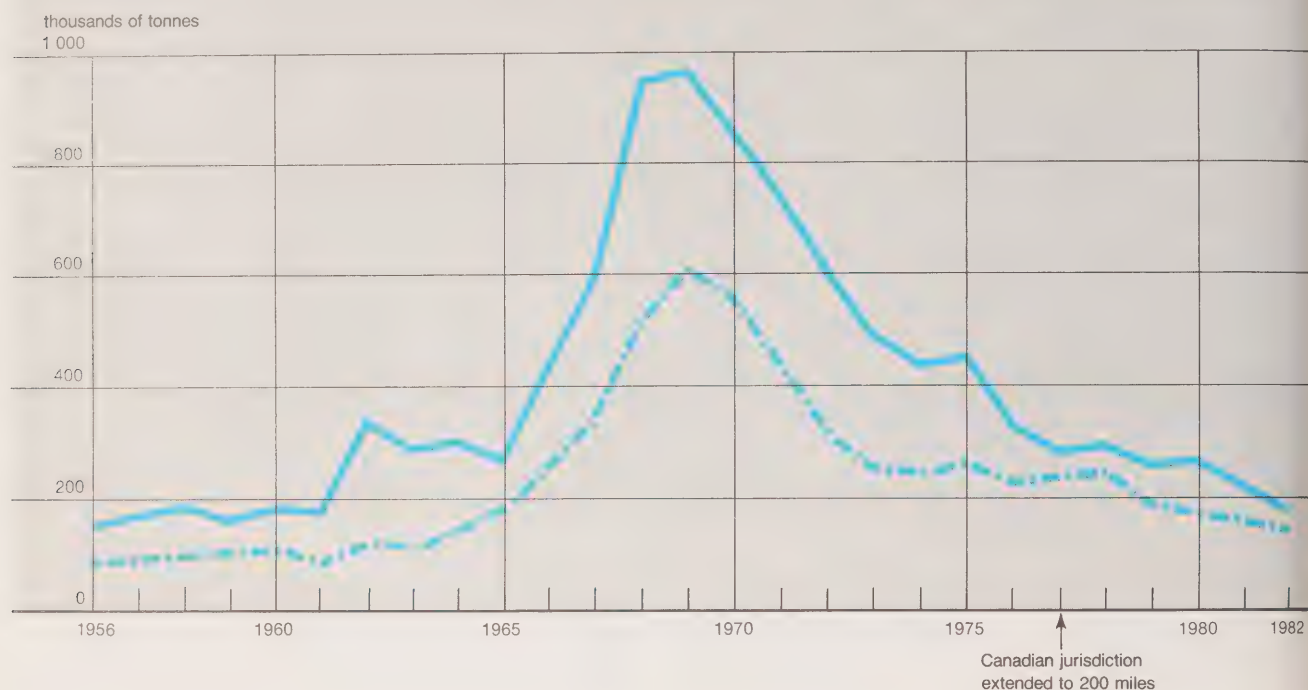
Canadian management of cod stocks (Map 3.3.1, subareas 2, 3 and 4) began through the use of a quota system introduced in the early 1970s and the extension of the three mile territorial sea to twelve miles in 1971 and to 200 miles in 1977. This progressively restricted the activity of foreign vessels in the Northwest Atlantic. The catch also includes a small fishery beyond the continental shelf in subarea 3.

Cod areas, in addition to the two areas selected for presentation on the graph, are the Gulf of St. Lawrence and the banks on the edge of the Scotia Shelf.

Sources:

International Commission for the Northwest Atlantic Fisheries, *Statistical Bulletins*, Volumes 2 to 28 Dartmouth, years 1959 to 1980 (annual).
Northwest Atlantic Fisheries Organization, *Statistical Bulletins*, Volumes 29 to 32 Dartmouth, years 1981 to 1984 (annual).

Chart 3.3.7
Catch of Herring in the Northwest Atlantic, 1956 to 1982



¹ This is largely an inshore fishery. The areas of abundant stocks are coastal Newfoundland, the Gulf of St. Lawrence, the Scotia Shelf, Bay of Fundy, and the Gulf of Maine. Fisheries and Oceans Canada feels that the Georges Bank stock is seriously depleted due to overfishing during the late 1960s. Rebuilding of stocks will depend on joint Canada-U.S. management and regulation of the fishery of juvenile herring.

² These areas were fished almost exclusively by Canadian vessels until 1962 when USSR and Eastern European vessels entered the fishery. With the expansion of Canadian territorial waters to 200 miles, these areas were closed to foreign vessels.

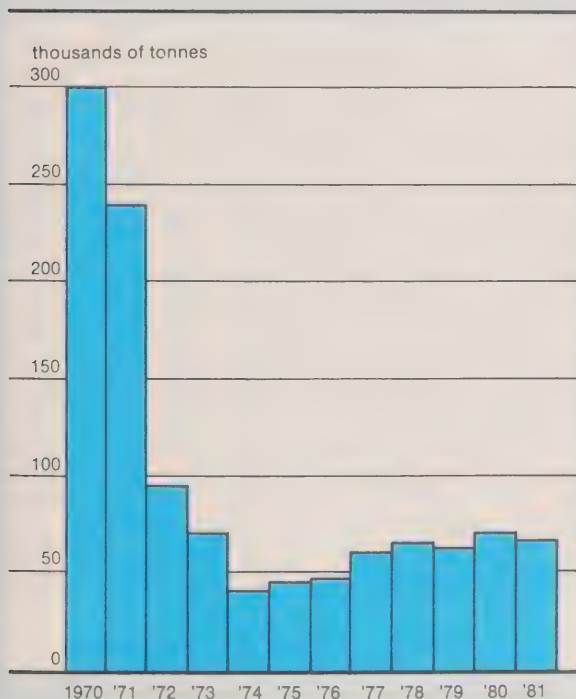
Sources:

International Commission for the Northwest Atlantic Fisheries, *Statistical Bulletins*, Volumes 6 to 28, Dartmouth, years 1958 to 1980 (annual).
Northwest Atlantic Fisheries Organization, *Statistical Bulletins*, Volumes 29 to 32, Dartmouth, years 1981 to 1984 (annual).

Technical Box 3.3.8

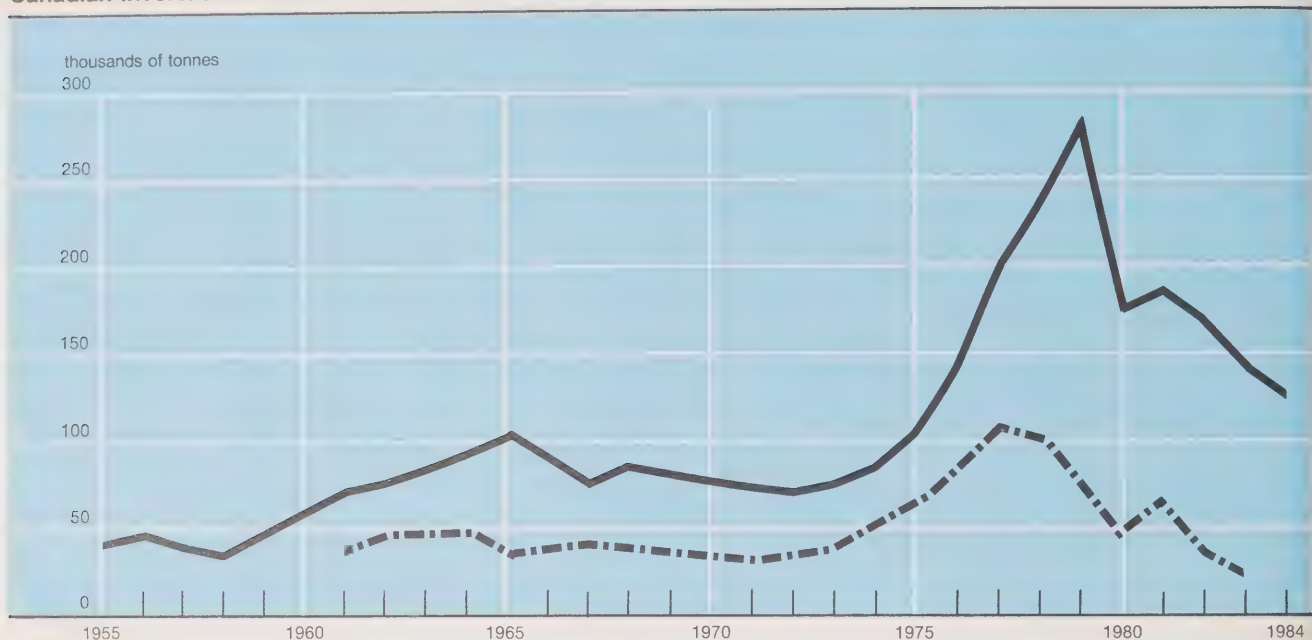
Gulf of St. Lawrence Herring Catch

The herring fishery is mainly a near-shore operation with the highest catch per unit effort obtained by focussing on schooling fish before they spawn. The fish which are not caught are relied upon to regenerate the stock. The exceptionally large numbers of fish hatched in 1958 and 1959 produced abundant fishable stocks which supported an increasingly large fishing fleet in the years that followed. The high catch levels, however, were not sustainable. Pelagic fish have volatile population cycles controlled by natural factors such as changes in water temperature or nutrient-rich ocean currents. Since the dynamics of these and other factors are not fully understood, pelagic fisheries are difficult to manage. When natural factors reduced the size of later year classes, the catch fell off accordingly and left an over expanded fleet.



Source:
Department of Fisheries and Oceans, Resource Services Directorate,
Resource Prospects for Canada's Atlantic Fisheries, 1981-1987, Ottawa,
1981.

Chart 3.3.9
Canadian Invertebrate¹ Catch in the Northwest Atlantic, 1955 to 1984



Footnotes:

¹ Principal invertebrates caught are lobsters, scallops, snow crab, squid and shrimp. Smaller quantities of oysters, clams, mussels, and periwinkles are also caught. Foreign catch (other than U.S. and Greenland) in the Northwest Atlantic is limited to squid.

² The Georges Bank historically provided a large portion of the Canadian scallop catch. Time series data are available from 1961. From the early 1960s until 1977, Canada took ninety percent of the total Canada-U.S.A. scallop harvest on Georges Bank. After 1977, the Total Allowable Catch (TAC) was set lower and the number of licenses was limited in an attempt to conserve the stock. The USA, however, continued to fish without limiting entry. The settlement of the boundary dispute over the jurisdiction of the Georges Bank (see Map 3.3.2, footnote 4) gives Canada the northern portion which contains the major scallop beds.

Sources:

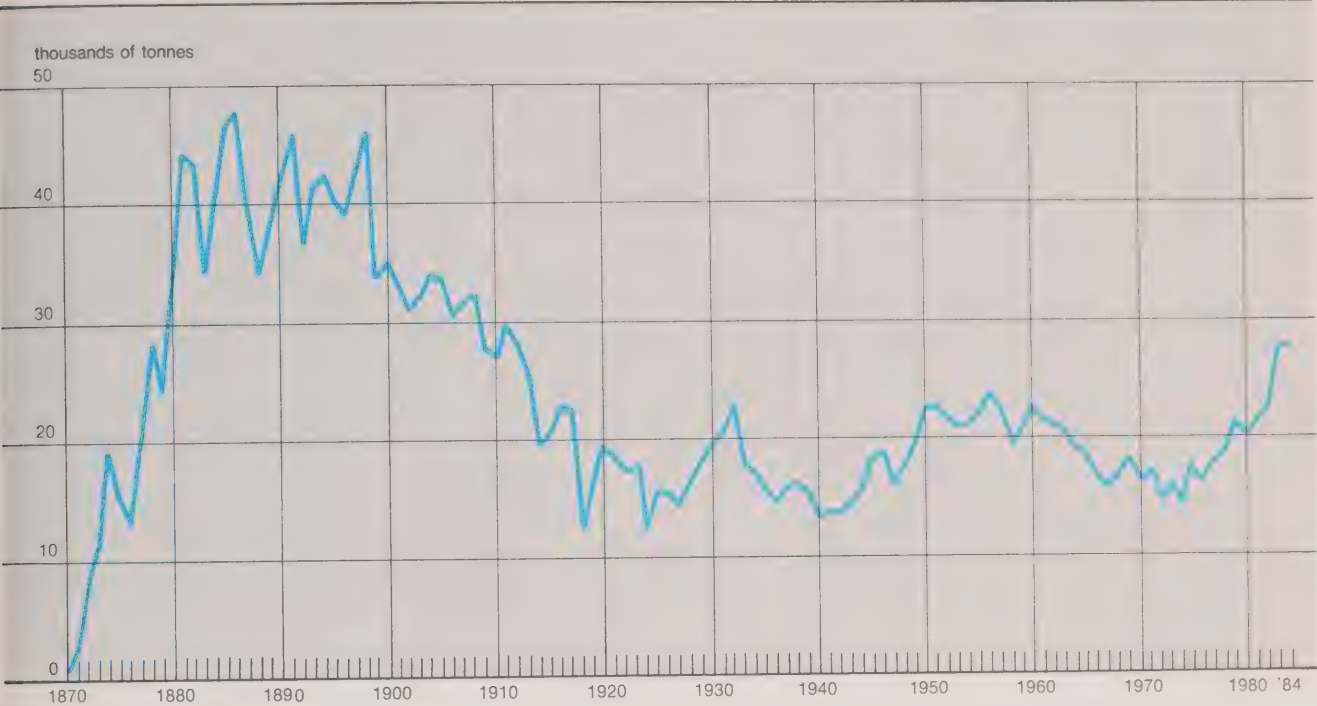
Department of Fisheries and Oceans, Economic Development Directorate, *Annual Statistical Review of Canadian Fisheries*, Volumes 9 to 15, Ottawa, years 1977 to 1984.

International Commission for the Northwest Atlantic Fisheries, *Statistical Bulletins* Volumes 11 to 28, Dartmouth, years 1963 to 1980 (annual).

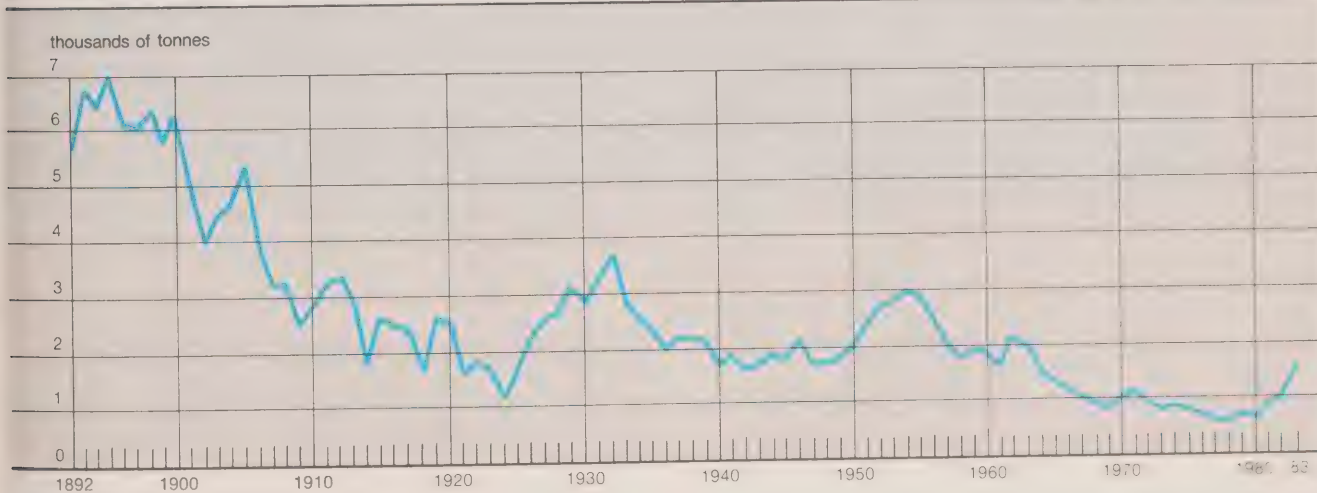
Northwest Atlantic Fisheries Organization, *Statistical Bulletins*, Volumes 29 to 32, Dartmouth, years 1982 to 1984 (annual).

— Total
- - - Georges Bank²

Chart 3.3.10
Atlantic Lobster Catch,¹ 1870 to 1984



Lobster Catch - Eastern Atlantic Coast² of Nova Scotia

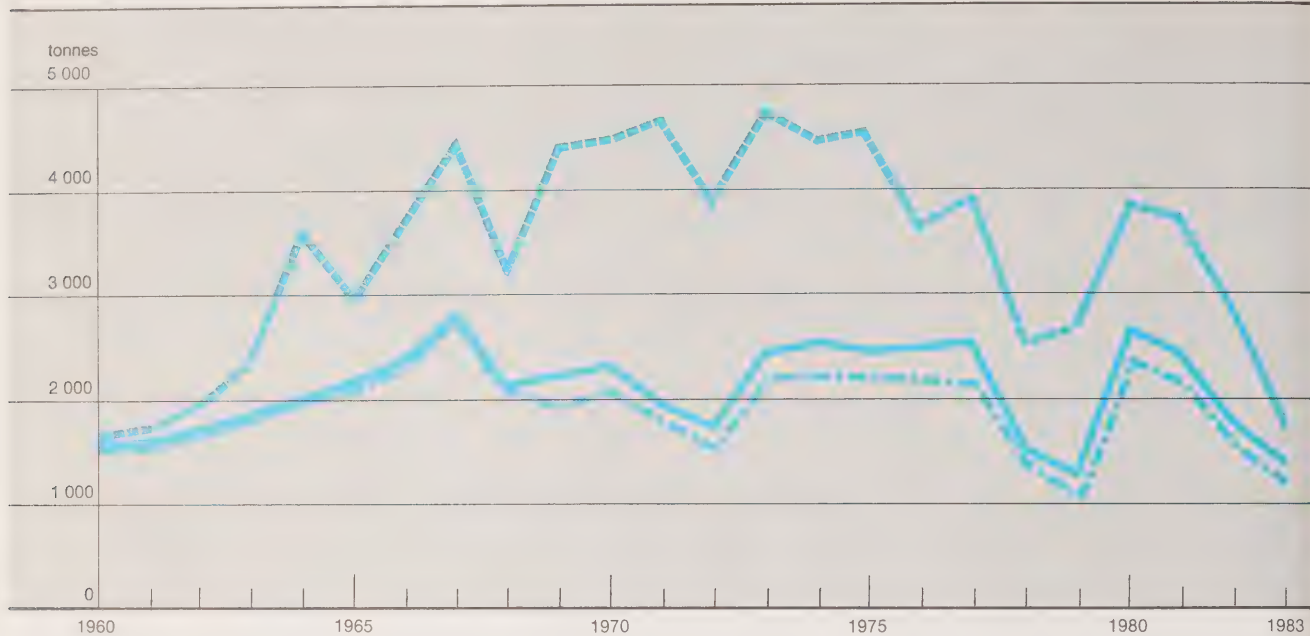


¹ Lobsters from the Southern Gulf of St. Lawrence account for fifty percent of the total. Catch data also include figures for Newfoundland.
² Includes shorelines of Richmond, Guysborough, Halifax and Cape Breton counties.

Sources:
Department of Fisheries, *History of the Lobster Fishery on the Eastern Shore of Nova Scotia* by D.G. Robinson, Canadian Technical Report, Fisheries and Aquatic Sciences, No. 954, Halifax, 1980.
Department of Fisheries and Oceans, unpublished data.

Note:
On the Atlantic coast, the increase in total catch from 1870 to 1890 is an example of the classic "fishing-up" period where the abundance of virgin stock attracted increasing numbers of fishermen. This catch level, however, was not a sustainable one. The average size of lobsters declined in this early period as well. On the eastern shore of Nova Scotia, the size of lobsters in 1900 was about the same as it is today. The drop in catch can be accounted for by over-fishing; this drop was further exacerbated by the catch of juvenile females (before reproductive age). Reduction of the fishing effort in the 1970s has allowed a greater number of females to reach reproductive maturity and this has resulted in the beginning of a return to larger catches.

Chart 3.3.11
Catch of Salmon in the Northwest Atlantic, 1960 to 1983



¹ Canada, Denmark (Greenland and Faroe Islands) and Norway.

² Includes commercial, sportfish and native harvests.

Sources:

Department of Fisheries and Oceans, Economic Development Directorate, *Annual Statistical Review of Canadian Fisheries*, Volumes 9 to 14, Ottawa, years 1977 to 1983.

International Council for the Exploration of the Sea; data courtesy of Department of Fisheries and Oceans, Resource Research Branch.

Note:

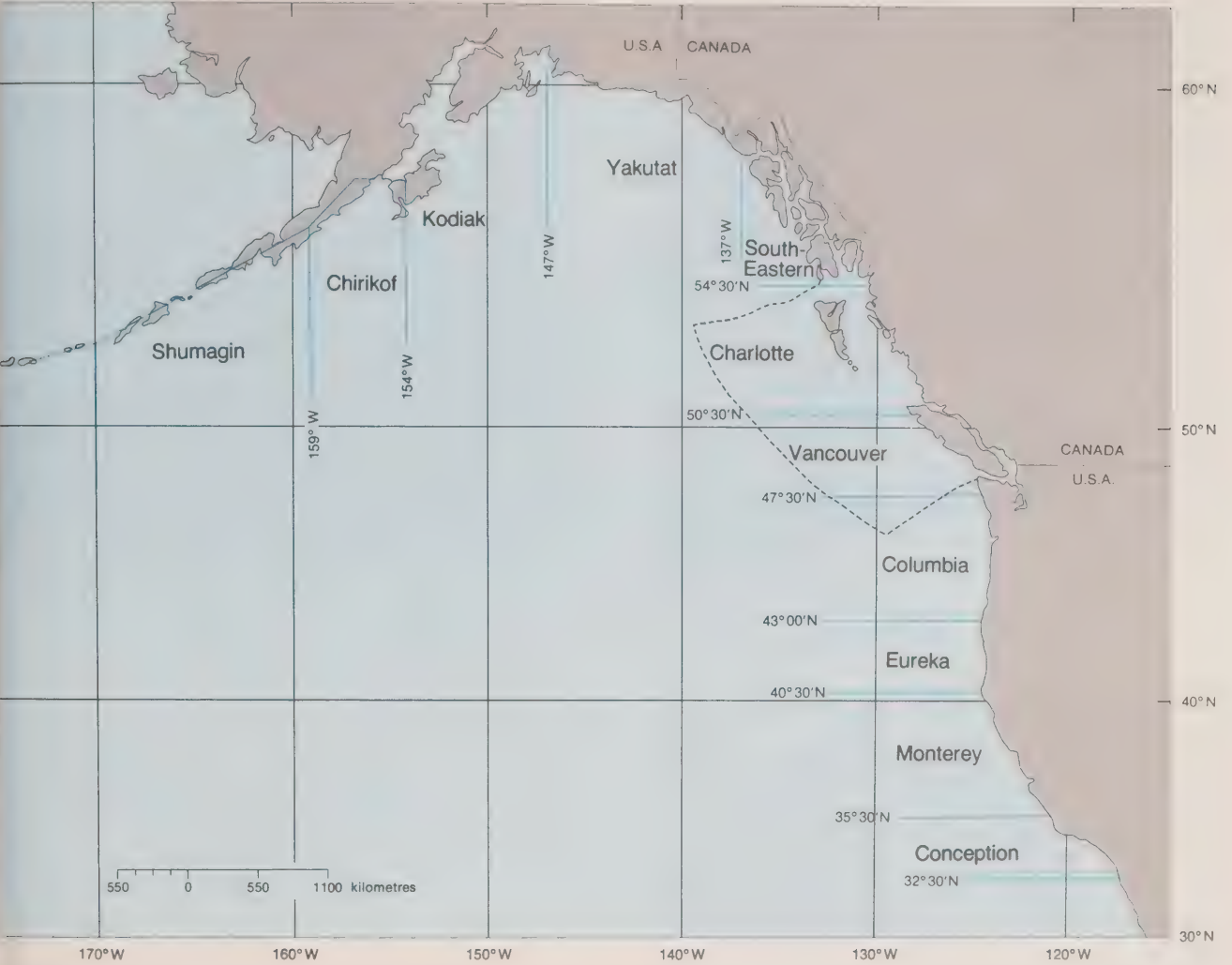
Canadian vessels fish exclusively south from Labrador (Map 3.3.2 subareas 2, 3, and 4). The other nations fish off Greenland (subarea 1). In 1976, a catch quota was imposed on the West Greenland fishery (subarea 1) and participation was limited to Greenland vessels. Although not all salmon caught off Greenland originated in Canadian streams, the Greenland salmon fishery is thought to be a factor in the decline of salmon returning to the spawning streams of Atlantic Canada.

--- Total international catch¹

— Total Canadian catch²

... Canadian commercial catch

Map 3.3.12
Northeast Pacific Fisheries Management Zones



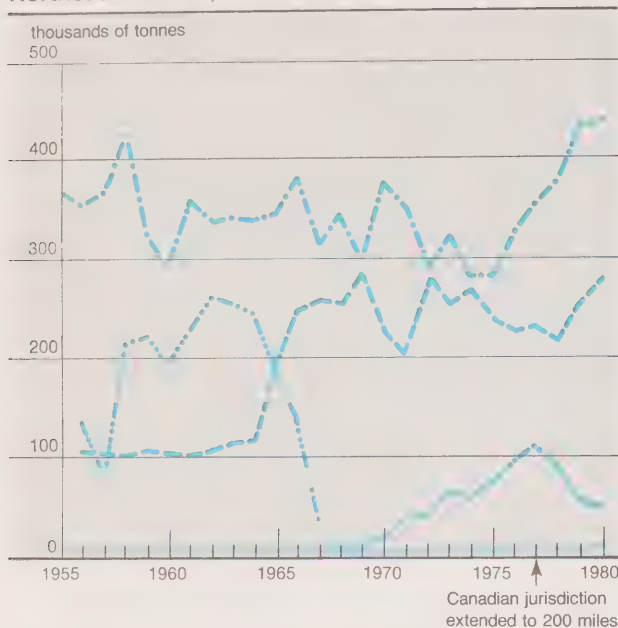
¹ The International North Pacific Fishing Commission was established in 1953 by convention between Canada, Japan and the United States for conservation of the fisheries resource. It is a management body which sets catch limits and coordinates scientific studies and data collection.

² Foreign vessels are not permitted to fish in Canadian waters except in cases where Canadian vessels do not meet catch levels established by the Commission.

Source:
International North Pacific Fisheries Commission, *Statistical Yearbook*, 1980, Vancouver.

— Boundary of INPFC¹ convention areas
- - - Boundary of 200 mile limit²

Chart 3.3.13
Catch¹ by Species Groups in the
Northeast Pacific², 1955 to 1980



--- Salmon
— Groundfish

..... Invertebrates³
-.-.- Herring

- ¹ Catch includes Canada, United States and Japan (since 1963) and the USSR and European countries (since 1965). Fish catches are normally reported by the flag of the fishing vessel; however, fish are also sold at sea and this catch is reported by the flag of the buying nation ("joint venture catch").
² The area is a management and reporting unit stretching from California to the Aleutian Islands (see Map 3.3.12).
³ Since invertebrates are less mobile and thus have a limited range, only Canadian catch is considered here.

Sources:

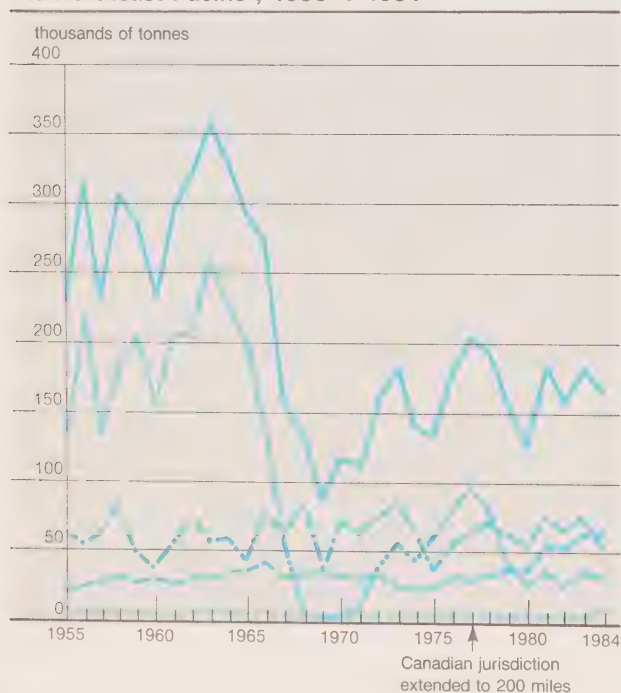
International North Pacific Fisheries Commission, *Statistical Yearbooks*, Vancouver, years 1955 to 1980.

Department of Fisheries and Oceans, Offshore Division, Vancouver, unpublished data.

Note:

Since "totals" are not actually calculated by the Commission, a total is not plotted on this graph.

Chart 3.3.14
Canadian Commercial Catch by Species Groups in
the Northeast Pacific¹, 1955 to 1984²



— Total³
--- Salmon⁴
— Groundfish⁵

..... Invertebrates
-.-.- Herring⁶

- ¹ A small quantity of groundfish were caught outside the Northeast Pacific area (i.e. the Bering Sea) by Canadian vessels until 1978. These data were not included in the total. (Catch did not exceed 3 000 tonnes in any one year).
² Figures for 1984 are preliminary.

³ Includes a small quantity of pelagic fish in addition to the categories shown.

⁴ Canadian salmon catch is partly made up of U.S. hatchery salmon and vice versa.

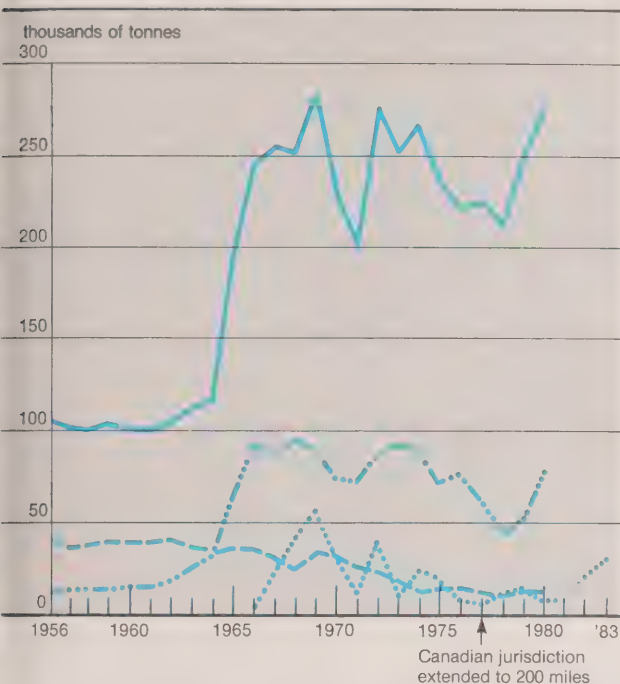
⁵ Includes halibut caught by Canadian fisherman but landed in U.S. ports.

⁶ The collapse of herring stocks in the 1960s is believed to be attributable to the exploitation of the fish since the 1950s for the herring reduction industry (processing of fish for oil and meal). The fishery was virtually closed from 1967 to 1971. The high-valued and extremely volatile roe-herring fishery began in 1972 when Japan relaxed import restrictions on roe. Greater than ninety-five percent of the present herring landings are comprised of roe-herring. (The remainder is a small food and bait fishery.) The mature fish are harvested for their roe when they are about to spawn. In order to keep harbours clean of offal after the removal of the roe, the carcasses are used in "reduction" for oil and meal.

Source:

Department of Fisheries and Oceans, Economic Development Directorate, *Annual Statistical Review of Canadian Fisheries*, Volumes 9 to 15, Ottawa, years 1977 to 1984.

Chart 3.3.15
**Catch¹ of Groundfish in the
 Northeast Pacific, 1956 to 1983**



¹ The sharp rise in catch after 1964 can be explained by the entry of Japan into this fishing area. Data on catch by Eastern European and other countries were collected after 1965.

² Groundfish total also includes sablefish, flounders, sole, Pacific cod and pollock.

³ Rockfish are a large group of species (Family Scorpaenidae).

⁴ Hake were not harvested until Eastern European nations began to fish in 1965. Since Canadian vessels do not meet the catch quota set by the Commission, foreign vessels, by arrangement, are allowed to fish within the 200 mile limit. There is also a 'joint venture catch' where Canadian vessels sell fish at sea.

⁵ Canadian and U.S.A. only, reported catch. Japan, in accordance with the North Pacific Convention, does not fish halibut east of the tip of the Aleutians (175° W).

Sources:

International North Pacific Fisheries Commission, *Statistical Yearbooks*, Vancouver, years 1956 to 1980. Department of Fisheries and Oceans, Vancouver, Offshore Division, unpublished data.

The Commission on Pacific Fisheries Policy, *Turning the Tide, A New Policy for Canadian Fisheries*, Peter M. Pearce, Commissioner, Vancouver, 1982.

Table 3.3.16
Commercial Catch¹ of Freshwater Fish, 1956 to 1983

Species	1956	1961	1966	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	Province of Highest Catch ²
tonnes																	
Trout ³	2 312	1 765	1 337	841	645	690	680	590	840	966	693	1 075	1 214	860	700	599	Ontario
Pike	3 169	3 567	3 568	3 025	3 422	3 277	3 336	3 365	3 383	3 888	3 920	4 162	4 301	3 742	4 666	3 352	Manitoba
Chub ⁴	3 856	4 717	4 941	1 632	1 591	1 794	2 181	2 105	2 076	1 853	1 972	1 931	2 325	2 248	1 686	1 327	Ontario
Whitefish	10 380	12 331	9 303	8 040	8 289	7 632	6 769	7 660	7 852	9 205	8 550	9 479	10 263	8 275	7 849	8 273	Manitoba
Perch	5 806	8 945	10 149	7 260	7 948	8 963	6 401	4 672	3 322	4 667	4 936	6 140	6 526	5 042	5 223	3 787	Ontario
Walleye	9 490	6 054	5 075	2 859	3 176	3 534	3 602	3 788	4 572	5 681	4 339	4 588	5 533	6 214	6 857	5 991	Manitoba
Sauger	2 009	1 497	2 192	312	1 708	1 924	1 660	1 935	1 689	1 595	1 335	1 287	1 725	1 767	1 781	1 881	Manitoba
Arctic Char ⁵	..	..	..	..	..	..	..	..	..	..	124	89	81	64	95	52	N.W.T.
Total High Value Species	37 022	38 877	36 565	23 969	26 779	27 814	24 629	24 115	23 734	27 855	25 869	28 751	31 968	28 212	28 857	25 262	...
Sucker	..	..	..	..	..	..	..	..	..	..	2 566	3 146	5 543	1 664	3 493	4 055	Manitoba
Smelt ⁶	1 838	5 956	7 302	6 149	5 015	7 794	7 667	7 862	8 276	10 667	12 399	10 979	11 426	13 901	19 808	13 429	Ontario
Alewife ⁷	..	..	..	..	..	..	..	..	..	..	2 221	1 671	522	1 338	1 115	887	New Brunswick
Carp	1 109	722	1 170	365	380	329	286	329	293	213	711	760	1 522	1 284	703	643	Manitoba
Total Low Value Species	2 947	6 678	8 472	6 514	5 395	8 123	7 953	8 191	8 569	10 880	17 897	16 556	19 013	18 187	25 119	19 014	...
Other Fish ⁸	16 547	10 271	10 014	11 028	11 352	9 592	14 425	10 173	7 367	8 300	3 805	3 845	3 316	3 557	3 758	4 542	...
Total	56 516	55 826	55 051	41 511	43 526	45 529	47 007	42 479	39 670	47 035	47 571	49 152	54 297	49 956	57 734	48 818	...

¹ Liveweight, i.e. weight of fish brought ashore.

² Ranked according to tonnage of 1983 catch.

³ Includes lake and rainbow trout. No commercial catches of rainbows have been reported since 1979.

⁴ Ciscos and lake herrings are marketed collectively as chub.

⁵ Data are for the Northwest Territories only; however, this fish is also caught commercially in Québec and Labrador.

⁶ Over ninety-five percent of smelt caught are from Lake Erie.

⁷ Some New Brunswick and all Great Lakes alewife are caught for animal feed and are not reported here.

⁸ Other fish include tomcod, eel, salmon, shad, white bass, sturgeon, catfish, burbot, rock bass, sunfish, splake, bullhead, freshwater drum, bowfin.

Sources:

Department of Fisheries and Oceans, Economic Development Directorate, *Annual Statistical Review of Canadian Fisheries*, Volumes 9 to 16, Ottawa, years 1977 to 1985. Data are collected by the provinces and forwarded to the federal department.

Note:

In 1980, Fisheries and Oceans Canada, in conjunction with the Provincial Agencies, conducted a sportfishing survey. Licensed anglers were asked to report the number of fish caught and retained by species. Estimated total weight nationally (excluding Québec) of fish retained by anglers was 73,200 tonnes.

Table 3.3.17
Commercial Catch of Freshwater Fish in Ontario¹, 1962 to 1982

Year	Lake Ontario	Lake Erie ²	Lake St. Clair ³	Lake Huron	Lake Superior	Inland Waters		Total Catch
						Northern	Southern	
tonnes								
1962	795	20 187	468	1 895	1 428	3 892	293	28 958
1963	929	16 027	474	1 668	1 350	3 832	392	24 672
1964	915	11 523	429	1 801	1 218	3 604	264	19 754
1965	1 202	15 934	402	1 620	1 031	3 443	199	23 831
1966	738	18 807	426	1 325	838	3 183	263	25 580
1967	832	17 148	368	1 210	1 166	3 008	288	24 020
1968	912	17 894	509	1 103	1 538	3 092	252	25 290
1969	1 031	21 804	417	1 058	1 340	2 759	286	28 695
1970	1 319	14 417	39	964	1 535	2 448	198	20 920
1971	1 319	13 201	0	1 252	1 529	1 845	282	19 428
1972	1 156	13 703	0	1 009	1 660	1 762	242	19 612
1973	1 070	18 082	0	1 153	1 606	1 937	237	24 085
1974	1 073	17 563	0	1 530	1 790	2 003	205	24 164
1975	1 250	13 747	0	1 501	1 696	2 039	180	20 413
1976	1 311	11 570	0	1 748	1 751	1 940	178	18 497
1977	1 107	16 134	0	1 749	1 738	2 446	168	23 343
1978	1 112	18 072	0	1 700	1 834	2 352	140	25 210
1979	878	18 473	0	1 399	1 621	2 217	307	24 895
1980	891	19 490	37	1 277	2 151	2 080	234	26 485
1981	1 163	20 334	93	2 121	2 060	2 154	233	28 158
1982	939	26 989	153	1 915	1 515	2 091	197	33 799

Principal species caught in each lake and region are as follows: *Lake Ontario* - carp (declined in 1979), yellow perch; *Lake Erie* - rainbow smelt, yellow perch, white bass; *Lake Huron* - lake whitefish, cisco; *Lake Superior* - lake whitefish, lake herring, walleye (declined in 1968); *northern inland waters* - lake whitefish, walleye.

The species of highest commercial catch in Lake Erie since the early 1960s is smelt.

³ No commercial catch was reported between 1970 and 1980 in Lake St. Clair as a result of the discovery of mercury contamination and the ensuing closure of the commercial fishery. Similar bans have affected fisheries in other parts of Lakes Ontario and Erie and other inland waters.

Source:

Ontario Ministry of Natural Resources, *Statistics*, Toronto, years 1973 to 1983.

Technical Box 3.3.18

Fish Catch: An Indicator of Change in the Great Lakes Ecosystem

During this century, the Great Lakes have experienced changes in the abundance and the mix of species. While tonnage of landed catch has more than doubled, the contribution of high value species declined to a low during the 1960s. (see chart) In general, high value species are more sensitive to fishing pressure, nutrient loadings, predation and competition from introduced species, and habitat restrictions than are low value species (yellow perch and lake herring are anomalies). Thus, a comparison of landings of the two groups is a general indicator of the state of the Great Lakes environment. Historical overfishing of accessible fish (benthics and large pelagics) allowed the population of the small pelagics to expand in the absence of predation. This is illustrated by the changes in the ratios in the lower lakes. In addition to overfishing, nutrient loadings from human activities seem to have contributed to the destabilization of the lower lakes ecosystem. The possible net effect would be the disruption of harmonic communities of species.

Changes in Species Composition of Great Lakes Commercial Catch

Year	Lake Erie Ratios		Lake Ontario Ratios	
	Small Pelagics ¹ to Benthics ²	Small Pelagics to Large Pelagics ³	Small Pelagics to Benthics	Small Pelagics to Large Pelagics
1901	0.3	0.1	0.4	0.2
1911	0.3	<0.1	0.1	0.2
1921	0.2	0.1	<0.1	<0.1
1931	1.2	0.6	<0.1	<0.1
1941	0.4	0.6	0.1	<0.1
1951	0.4	0.5	0.3	0.6
1961	4.4	2.7	0.4	7.9
1971	7.3	15.4	16.9	35.4
1981	12.5	9.4	18.1	113.2

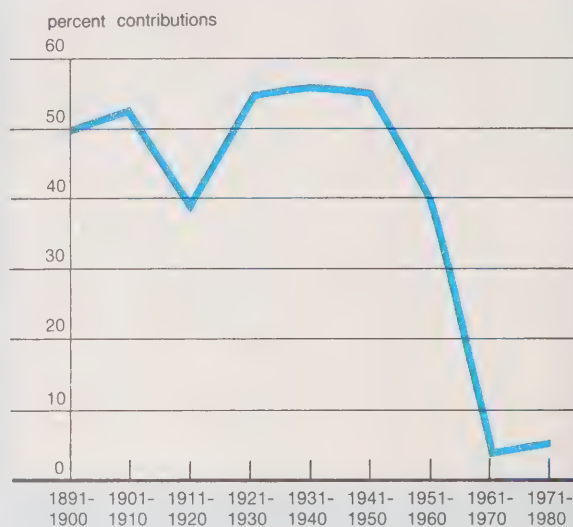
¹ Small pelagics include smelt, alewife, yellow perch.

² Benthics (bottom feeders) include lake whitefish, burbot, sturgeon, northern pike, sauger, carp, walleye, channel catfish, lake trout.

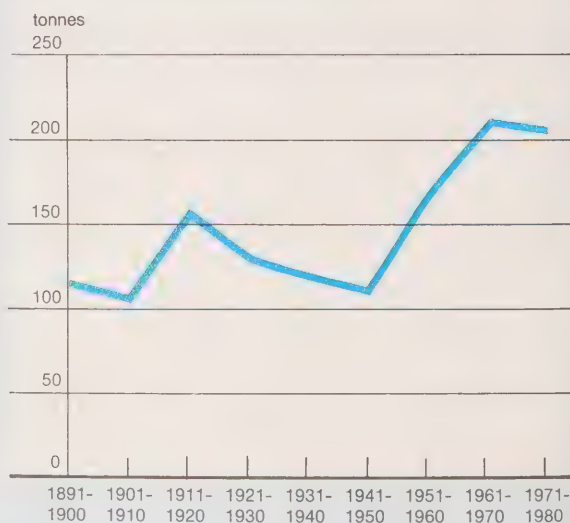
³ Large pelagics (open water fish) include blue pike, lake herring, white bass, sheepshead.

Source:

Great Lakes Fisheries Commission, *Technical Report No. 3* (revised) September 1979 and unpublished data.

Percentage Contribution of High Value Species¹ to Total Catch

Annual Average Canadian Catch over the Decade



¹ Species of fish preferred by consumers attract high market prices. High value species used for this calculation are blue pike, (now extinct) lake trout, lake whitefish, sauger and walleye.

Source:

International Joint Commission, *1981 Report on Great Lakes Water Quality, Appendix, Great Lakes Surveillance*, November 1981 and unpublished data from the Great Lakes Fisheries Commission, Ann Arbor, Michigan.

Table 3.3.19
Persons Employed in the Fishing Industry, 1951 to 1983

	Atlantic ¹		Pacific ²		Continental ³		Canada	
	Fishermen ⁴	Plant Workers ⁵	Fishermen	Plant Workers	Fishermen	Plant Workers	Fishermen	Plant Workers
1951*	36 450	14 102	13 213	4 604	15 016	...	64 679	18 706
1961	44 652	10 506	16 805	3 632	16 903	643	78 360	14 781
1971	39 726	14 995	11 015	2 599	8 104	916	58 845	18 510
1972	39 741	15 506	9 902	3 558	7 741	1 036	57 384	20 100
1973	38 996	16 630	11 717	3 702	8 534	1 092	59 247	21 424
1974	36 464	14 236	11 906	3 413	8 247	1 125	56 617	18 774
1975	40 564	12 916	12 578	3 051	7 889	1 020	61 031	16 987
1976	40 785	14 738	14 018	3 830	8 582	1 000	63 385	19 568
1977	...	16 922	13 753	4 074	...	941	...	21 937
1978	48 533	19 683	16 785	4 555	8 291	993	73 609	25 231
1979	55 885	22 445	19 834	4 229	8 197	1 321	83 916	27 995
1980	59 252	21 909	18 871	3 950	7 829	1 225	85 952	27 084
1981	53 250	22 168	17 454	4 208	8 056	1 110	78 760	27 486
1982*	46 973	21 604	17 298	3 040	8 201	1 208	72 472	25 852
1983	56 499	..	17 061	..	8 074	..	81 634	..

* Includes the sea fisheries of the Atlantic Provinces and Québec.

Includes the sea fishery of British Columbia.

Includes the freshwater fisheries of New Brunswick, Québec, Ontario, Prairie Provinces and the Northwest Territories.

The number of fishermen, historically, was based on field enumeration. Formal licensing of fishermen began in Newfoundland in 1974 and in the Maritime provinces in 1978. All individuals, including crew members, who engage in fishing to sell any part of their catch must purchase a federal commercial fishing license.

Until 1980, the number of persons reported in the Census of Manufactures refers to the "average number of employees". The number of workers in each establishment is obtained by adding the number of persons employed in each month and dividing by twelve. Since 1980, the actual numbers of people employed in fish processing are counted.

Data for Newfoundland and Labrador are not included before 1961.

Data for the Atlantic Provinces are incomplete for 1977 due to the conversion from field enumeration to a licensing system.

The province of Québec did not report data for 1982.

Sources:

Department of Fisheries and Oceans, Economic Development Directorate, *Annual Statistical Review of Canadian Fisheries*, Volumes 9 to 15, Ottawa, 1977 to 1984.

Statistics Canada, *Fisheries Statistics of Canada*, Catalogue 24-201, 1951, 1961, 1971 to 75, annual.

Statistics Canada, *Fish Products Industry*, Catalogue 32-216, annual.

Note:

The difference between the number of fishermen reported in the Census and by the Department of Fisheries and Oceans is the result of methodological differences. The Fisheries and Oceans figure is obtained from a count of registered fishermen, whereas the Census covers persons who claimed the occupation of fishing one week prior to the Census date (June 1st), unless they were unemployed, in which case the occupation of the longest employment period since January 1st of the previous year is used. The lower figure indicated by the Census is partly accounted for by the seasonality of this industry (low in week of Census), and because part-time fishermen may not consider fishing as primary activity. On the other hand, registered fishermen may not be active in the year of registration, or may only be employed part-time.

Table 3.3.20
Socio-Economic Profile of Fishermen, 1981

Region	Total Employed		Full-Time Employed						
	Persons	Average Income	Persons ⁴	Average Income	As a Percentage of All Employment	Percentage Self Employed ⁵	Age Forty-five Years and Over	Education Level	
								Less than Grade Nine	Post Secondary ⁶
	dollars	dollars		dollars	percent	percent	percent of total employed		
Atlantic ¹	25 215	8 823	9 400	13 072	37	53.2	28	42	24
Continental ²	8 930	9 418	3 930	14 280	44	30.9	33	30	37
Pacific ³	7 685	12 766	3 440	16 349	40	22.9	25	11	50
Canada	41 830	9 675	16 770	14 027	40	43.8	29	32	32

¹ Atlantic region includes Census Divisions in the Atlantic Provinces and Québec in which marine fishermen reside.

² Continental region includes Québec, Ontario and the Prairie Provinces.

³ Pacific region includes Census Divisions in British Columbia in which marine fishermen reside.

⁴ A person employed in the fishing industry is defined as having worked at least twenty-seven weeks in 1980 and claimed employment in the fishing industry during the week prior to the Census date or if not employed during that week, having worked in the fishing industry at least twenty-seven weeks in 1980. Unpaid family workers are not included.

⁵ Self employed persons are all full-time workers less wage-earners, less unpaid family workers.

⁶ Post-secondary education refers to trade certificates and university degrees.

Sources:

Statistics Canada, 1981 Census of Canada, special tabulations.

Note:

The difference between the number of fishermen reported in the Census and by the Department of Fisheries and Oceans is the result of methodological differences. The Fisheries and Oceans figure is obtained from a count of registered fishermen, whereas Census covers persons who claimed the occupation of fishing one week prior to the Census date (June 1st), unless they were unemployed, in which case the occupation of the longest employment period since January 1st of the previous year issued. The lower figure indicated by the Census is partly accounted for by the seasonality of this industry (low in week of Census), and because part-time fishermen may not consider fishing as their primary activity. On the other hand, registered fishermen may not be active in the year of registration, or may only be employed part-time.

4

Extraction and Depletion of Non-Renewable Resources



Contents

4.1	Metals and Non-Metallic Minerals	143
4.2	Fossil Fuels	153

Tables

4.1.1	Production of Metallic Minerals, 1888 to 1982	144
4.1.4	Production of Selected Non-Metallic Minerals, 1888 to 1982	146
4.1.8	Production and Reserves of Metallic Minerals by Ecozone, 1981	151
4.2.2	Consumption of Energy by Fuel Type, 1870 to 1983	155
4.2.3	Consumption of Energy by Sector and Fuel Type, 1983	155
4.2.6	Energy Consumption by Ecozone and Sector, 1982	157
4.2.8	Fossil Fuel Production and Consumption, 1868 to 1982	159
4.2.10	Estimated Reserves of Conventional Crude Oil, 1960 to 1984	161
4.2.11	Estimated Reserves of Natural Gas, 1960 to 1984	161
4.2.15	Estimated Reserves of Conventional Oil by Ecozone, as of December 31, 1981	164
4.2.17	Estimated Tar Sands Oil Reserves, Alberta Boreal Plain, as of December 31, 1981	166
4.2.18	Estimated Reserves of Natural Gas by Ecozone, as of December 31, 1981	166
4.2.21	Coal Reserves by Ecozone, 1982	169
4.2.22	Coal Production by Ecozone, 1981	169
4.2.23	Socio-Economic Profile of Persons Employed in the Mining and Oil Extraction Industry by Ecozone, 1981	170

Maps

4.1.6	Principal Mining Regions	148
4.2.14	Oil and Gas Production and Exploration Activities, 1983	163
4.2.20	Coal Mining Activity and Resources, 1983	168

Charts

4.1.2	Production of Selected Metallic Minerals, Twenty-five Year Periods, 1908 to 1982	145
4.1.3	Production of Selected Metallic Minerals, Twenty-five Year Periods, 1908 to 1982	145
4.1.5	Production of Selected Non-Metallic Minerals, Twenty-five Year Periods, 1908 to 1982	147
4.2.1	Domestically Available Energy and Net Energy Imports, 1870 to 1983	154
4.2.4	Energy Consumed by Sector, 1958, 1972 and 1983	156
4.2.5	Energy Consumed in the Transportation Sector, by Mode of Transport, 1958, 1972 and 1983	156
4.2.7	Energy Consumption per Capita in Selected Countries, 1965 and 1983	158
4.2.9	Production and Consumption of Fossil Fuels, Twenty-five Year Periods, 1883 to 1982	160
4.2.12	Oil and Gas Depletion Indices	162
4.2.13	Oil and Gas Reserves, Life Indices	162
4.2.16	Oil Depletion Index by Ecozone, as of December 31, 1981	165
4.2.19	Natural Gas Depletion Index by Ecozone, as of December 31, 1981	167

Technical Box

4.1.7	Non-Renewable Resources and the Measurement of Reserves	150
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4.1

Metals and Non-Metallic Minerals



Table 4.1.1
Production of Metallic Minerals, 1888 to 1982

Five-Year Periods ¹	Iron Ore ²	Copper	Nickel	Lead	Cobalt
thousands of tonnes					
1888-1892	374	16	4	0	0
1893-1897	437	21	9	40	0
1898-1902	883	58	17	87	0
1903-1907	1 212	111	38	98	1 083
1908-1912	1 081	139	73	82	5 117
1913-1917	1 307	218	150	88	1 919
1918-1922	559	166	107	132	1 245
1923-1927	28	261	154	515	2 041
1928-1932	0	587	185	690	1 629
1933-1937	0	923	347	792	1 423
1938-1942	1 452	1 398	567	1 021	1 058
1943-1947	5 260	1 096	561	804	439
1948-1952	16 846	1 176	601	744	2 323
1953-1957	67 835	1 448	768	894	6 629
1958-1962	99 320	1 883	913	930	7 300
1963-1967	173 670	2 329	1 068	1 193	7 699
1968-1972	208 526	3 079	1 213	1 654	8 854
1973-1977	248 213	5 665	1 234	1 523	7 271
1978-1982	235 356	7 311	695	1 451	8 346
Total	1 062 359	27 885	8 704	12 738	64 376

Five-Year Periods ¹	Molybdenum	Magnesium	Uranium	Silver	Gold	Platinum Group
tonnes						
1888-1892	0	0	0	61	8	0
1893-1897	0	0	0	361	20	0
1898-1902	3	0	0	689	163	0
1903-1907	77	0	0	1 059	104	0
1908-1912	0	0	0	4 573	78	0
1913-1917	2 009	0	0	4 187	130	0
1918-1922	455	0	0	2 579	138	0
1923-1927	34	0	0	3 225	252	1
1928-1932	9	0	0	3 435	363	4
1933-1937	7	0	0	2 785	530	16
1938-1942	209	372	0	3 473	787	25
1943-1947	2 394	11 528	0	2 145	472	25
1948-1952	588	0	0	3 276	652	21
1953-1957	1 408	16 321	8 098	4 499	678	25
1958-1962	1 812	33 237	54 533	4 943	695	52
1963-1967	24 308	39 897	25 174	5 034	552	62
1968-1972	62 162	39 986	18 732	6 955	374	67
1973-1977	71 940	38 648	27 635	6 638	272	63
1978-1982	66 656	54 658	36 310	5 964	264	45
Total	234 071	234 647	170 482	65 881	6 532	410

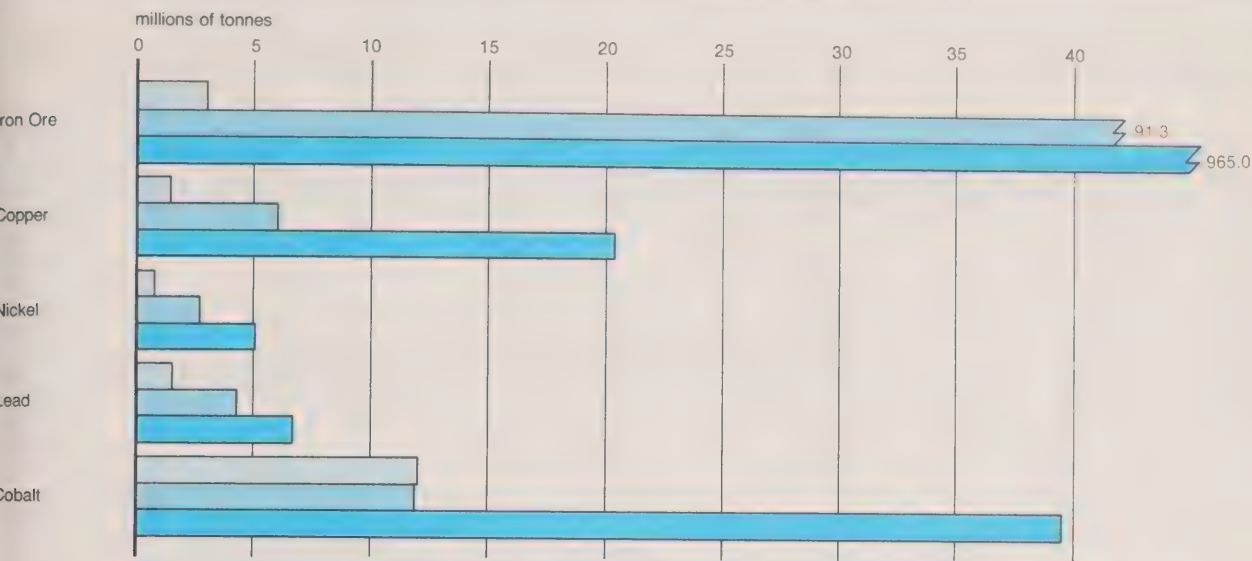
¹ Figures shown are totals for the five-year periods. The totals at the bottom of the columns are the totals for the 1888 to 1982 period.

² Iron ore production over the period from 1733 to 1886 is estimated to be one million tonnes: Energy, Mines and Resources Canada, *A Summary View of Canadian Reserves and Resources of Iron Ore*, MR 170, 1977, p.8. This source also estimates that iron ore, concentrates, pellets and sinter contained about fifteen percent iron over the period 1733 to 1975.

Sources:

Statistics Canada, *Historical Statistics Of Canada*, 2nd Edition, 1983.
Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, various years.

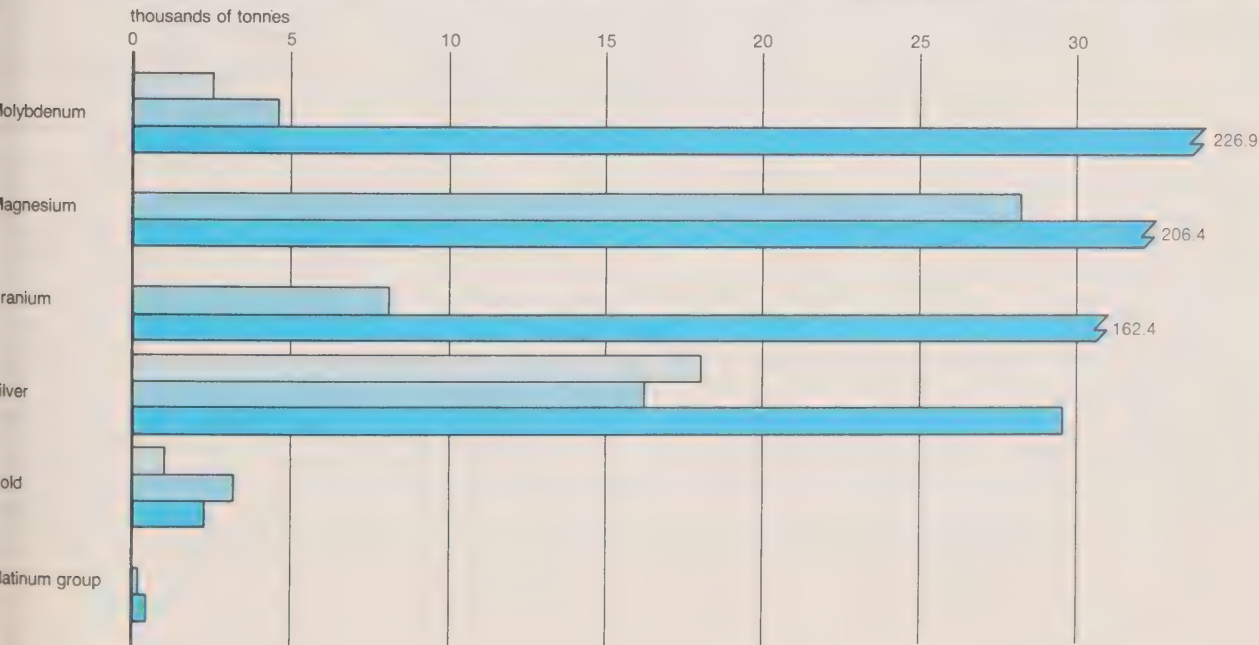
Chart 4.1.2
Production of Selected Metallic Minerals, Twenty-five Year Periods, 1908 to 1982



Sources:
Statistics Canada, *Historical Statistics of Canada*, 2nd edition, 1983.
Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, various years.

1908-1932
1933-1957
1958-1982

Chart 4.1.3
Production of Selected Metallic Minerals, Twenty-five Year Periods, 1908 to 1982



Sources:
Statistics Canada, *Historical Statistics of Canada*, 2nd edition, 1983.
Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, various years.

1908-1932
1933-1957
1958-1982

Table 4.1.4
Production of Selected Non-Metallic Minerals, 1888 to 1982

Five-Year Periods	Salt	Potash	Sulphur	Asbestos
thousands of tonnes				
1888-1892	205	0	114	32
1893-1897	241	0	75	59
1898-1902	273	0	63	144
1903-1907	316	0	73	299
1908-1912	395	0	123	493
1913-1917	544	0	496	657
1918-1922	759	0	279	702
1923-1927	1 067	0	57	1 166
1928-1932	1 292	0	202	1 005
1933-1937	1 644	0	389	1 120
1938-1942	2 309	0	960	1 740
1943-1947	3 015	0	1 100	2 334
1948-1952	3 888	0	1 440	3 691
1953-1957	5 927	0	2 703	4 499
1958-1962	14 393	0	3 990	4 974
1963-1967	19 432	6 667	10 869	6 373
1968-1972	23 442	16 041	17 448	7 430
1973-1977	27 651	25 883	26 001	7 444
1978-1982	35 730	31 898	34 326	6 165
Total	142 523	80 489	100 708	50 327

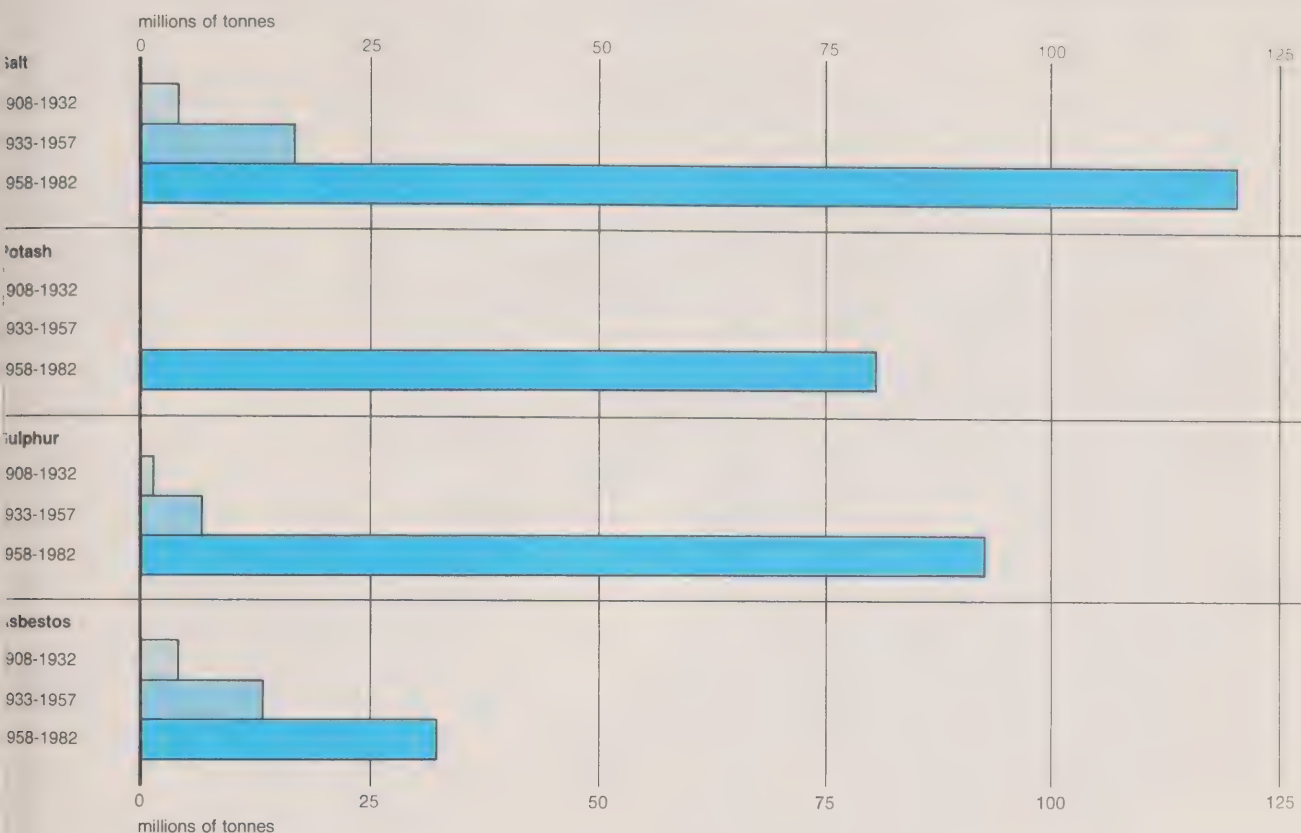
Sources:

Statistics Canada, *Historical Statistics of Canada*, 2nd Edition, 1983.

Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, various years.

Chart 4.1.5

Production of Selected Non-Metallic Minerals, Twenty-five Year Periods, 1908 to 1982



Source: Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, various years.

Map 4.1.6
Principal Mining Regions



Key to Principal Mining Regions

Atlantic Maritime

- 1 Sydney - Cape Breton (N.S.)
- 2 New Glasgow, (N.S.)
- 3 Wolfville - Stewiacke, (N.S.)
- 4 Moncton - Springhill, (N.B. - N.S.)
- 5 Minto, (N.B.)
- 6 Fredericton, (N.B.)
- 7 Bathurst, (N.B.)

Mixed-Wood Plain

- 8 Eastern Townships, (Que.)
- 9 Montreal, (Que.)
- 10 Ottawa Valley, (Ont. - Que.)
- 11 Hagersville, (Ont.)
- 12 Windsor, (Ont.)
- 13 Sarnia, (Ont.)
- 14 Goderich, (Ont.)

Boreal Shield

- 15 Avalon Peninsula, (Nfld.)
- 16 St. Lawrence, (Nfld.)
- 17 Buchans, (Nfld.)
- Coal, Gypsum
- Coal
- Gypsum, Pb, Zn, U
- Coal, Salt, Gypsum
- Coal, Potash
- Sb
- Pb, Zn, Cu
- Asbestos, Talc, Soapstone
- Silica, Magnesite, Magnesitic Dolomite
- Mg, Ca
- Gypsum
- Salt
- Salt
- Pyrophyllite
- Silica
- Zn, Pb, Cu, Ag, Au, Cd

- 18 Springdale - Baie Verte, (Nfld.)
- 19 Stephenville, (Nfld.)
- 20 Havre St. Pierre, (Que.)
- 21 Gaspé, (Que.)
- 22 Baie St. Paul, (Que.)
- 23 Maniwaki, (Que.)
- 24 Belleterre, (Que.)
- 25 Noranda - Val d'Or, (Que.)
- 26 Matagami, (Que.)
- 27 Chibougamau, (Que.)
- 28 Bancroft - Marmora, (Ont.)
- 29 Elliot Lake, (Ont.)
- 30 Sudbury Basin, (Ont.)
- 31 Kirkland Lake - Cobalt, (Ont.)
- 32 Timmins - Porcupine, (Ont.)
- 33 Algoma, (Ont.)
- 34 Long Lac, (Ont.)
- 35 Steep Lake, (Ont.)
- 36 Pickle Crow, (Ont.)
- 37 Red Lake, (Ont.)

- Cu, Au, Ag, Asbestos
- Gypsum
- Fe, Ti
- Cu, Mo
- Fe
- Ni, Cu, Fe
- Ni, Cu
- Cu, Zn, Ag, Au, Pb
- Zn, Cu
- Cu, Au, Ag
- Talc, Nepheline Syenite, Dolomite, U
- U
- Ni, Cu, Au, Ag, Platinum
- Metals, Co, Se, Te, Fe, U
- Au, Ag, Fe
- Zn, Cu, Au, Ag, Pb, Sn, Cd
- Fe
- Cu, Zn, Ag, Pb, Au
- Fe, Ni, Cu
- Cu, Ni, Ag
- Au, Cu, Zn, Ag, Fe

Key to Principal Mining Regions (concluded)

38 Bissett - Black Island, (Man.)	Silica
39 Flin Flon - Snow Lake, (Man.)	Cu, Zn, Au, Ag, Pb, Cd, Se, Te
40 Thompson, (Man.)	Ni, Cu, Co, Precious Metal Residues
41 Lynn Lake, (Man.)	Cu, Zn, Ag
42 Lac du Bonnet, (Man.)	Ta, Ce
43 La Ronge, (Sask.)	Cu, Ni, Zn, Pb
Prairie	
44 Morris - Morden, (Man.)	Bentonite
45 Neepawa, (Man.)	Gypsum
46 Estevan - Bienfait, (Sask.)	Coal
47 Regina - Moose Jaw, (Sask.)	Sodium Sulphate, Potash, Salt, Bentonite
48 Saskatoon, (Sask.)	Potash, Sodium Sulphate, Salt
49 Esterhazy, (Sask.)	Potash
50 Edmonton, (Alta.)	Coal, Barite, Silica
51 Forestburg, (Alta.)	Coal, Bentonite
52 Drumheller, (Alta.)	Coal
53 Lethbridge, (Alta.)	Coal
54 Lindbergh, (Alta.)	Salt
55 Metiskow, (Alta.)	Sodium Sulphate

Boreal Plain

56 Gypsumville, (Man.)	Gypsum
57 Key Lake, (Sask.)	U
58 Cluff Lake, (Sask.)	U
59 Athabasca Sandstone, - Rabbit Lake, (Sask.)	U
60 Luscar, (Alta.)	Coal
61 Peace River, (B.C.)	Coal

Montane Cordillera

62 Grande Cache, (Alta.)	Coal
63 Canmore, (Alta.)	Coal
64 Invermere, (B.C.)	Barite, Gypsum
65 Kimberley, (B.C.)	Pb, Zn, Ag, Sb, Cd, Bi, Sn, In
66 Coleman - Crow's Nest, (Alta. - B.C.)	Coal
67 Revelstoke, (B.C.)	Ag, Zn, Pb
68 Trail - Princeton, (B.C.)	Cu, Mo, Ag, Au, Pb, Zn
69 Highland Valley, (B.C.)	Cu, Mo, Ag, Au
70 Hope, (B.C.)	Cu, Au, Ag
71 Birch Island, (B.C.)	U
72 Caribou, (B.C.)	Cu, Mo, Ag
73 Central B.C., (B.C.)	Cu, Au, Ag, Mo

Pacific Maritime

74 Vancouver Island, (B.C.)	Cu, Mo, Au, Ag, Pb, Zn, Re
75 River Jordan, (B.C.)	Cu
76 Britannia Beach, (B.C.)	Au, Ag, Pb, Zn, Cd
77 Queen Charlotte Islands, (B.C.)	Fe, Cu, Ag
78 Stewart, (B.C.)	Cu

Boreal Cordillera

79 Cassiar, (B.C.)	Asbestos
80 Fort Nelson, (B.C.)	Cu, Pb, Zn
81 Clinton Creek, (Y.T.)	Asbestos
82 Carmacks, (Y.T.)	Coal
83 Faro, (Y.T.)	Pb, Zn, Ag, Cu, Cd
84 Whitehorse - Carcross, (Y.T.)	Cu, Au, Ag

Tundra Cordillera

85 Mayo, (Y.T.)	Ag, Pb, Zn, Cd
86 Tungsten, (Nw.T.)	W, Cu

Taiga Plain

87 Pine Point, (Nw.T.)	Zn, Pb
------------------------	--------

Taiga Shield

88 Labrador, (Que. - Nfld.)	Fe
89 Uranium City, (Sask.)	U
90 Great Bear Lake, (Nw.T.)	Ag, Cu
91 Mackay Lake, (Nw.T.)	Au, Base Metals
92 Yellowknife, (Nw.T.)	Au

Southern Arctic

93 Baker Lake, (Nw.T.)	U
------------------------	---

Northern Arctic

94 Purtunig - Hudson Strait, (Que.)	Asbestos
95 Arctic Bay, (Nw.T.)	Pb, Zn, Ag
96 Little Cornwallis Island, (Nw.T.)	Zn, Pb

List of Elements

Ag - silver	Ni - nickel
Au - gold	Pb - lead
Bi - bismuth	Re - rhenium
Ca - calcium	Sb - antimony
Cd - cadmium	Se - selenium
Ce - cerium	Sn - tin
Co - cobalt	Ta - tantalum
Cu - copper	Te - tellurium
Fe - iron	Ti - titanium
In - indium	U - uranium
Mg - magnesium	W - tungsten(wolftram)
Mo - molybdenum	Zn - zinc

Sources:

Environment Canada, Lands Directorate, *Mining, Land Use and the Environment*, by I.B. Marshall, 1982.
 Energy Mines and Resources Canada, *Principal Mineral Areas of Canada* (Map 900 A), 1983.

Technical Box 4.1.7

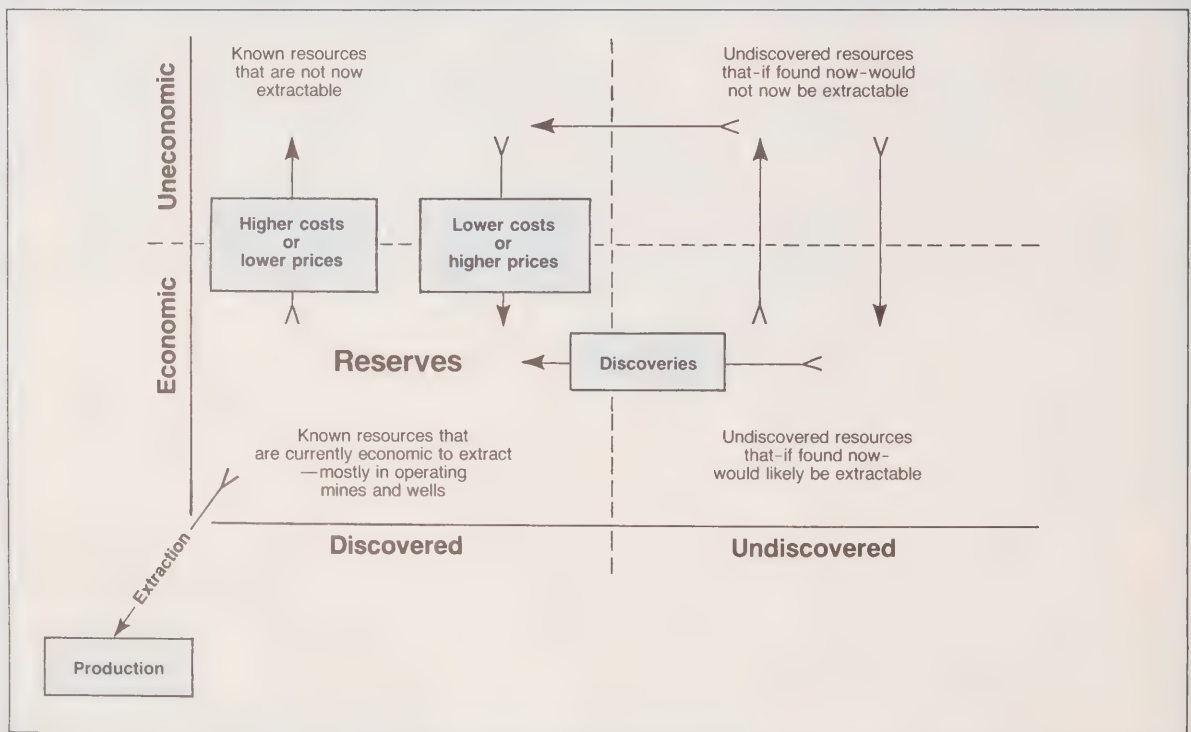
Non-Renewable Resources and the Measurement of Reserves

Energy, Mines and Resources Canada categorizes the availability of sub-soil resources (i.e. minerals and fossil fuels) on the basis of (i) economic viability and (ii) level of certainty or probability of their existence. **Reserves** refer to the portion of resources that is currently judged to be economic to exploit and is reasonably well measured.

Additions to, or subtractions from, reserves are calculated on the basis of: (i) **production** (i.e. depletion), (ii) **change in costs** which includes both technological improvements and costs of production (i.e. labour, capital, materials) (iii) **changes in price**, which in Canada are

largely determined by international competition and world demand, (iv) **revision of previous estimates of reserves**, by more accurate delineation of mineral bodies, for example, and (v) **new discoveries**.

A conventional reserve/production ratio is sometimes used as a rule-of-thumb to determine the level and intensity of mineral exploration considered necessary to provide sufficient reserves to satisfy anticipated medium-term demand¹. This explains, in part, the counter-intuitive observation of growth in production with a parallel growth in reserves.

Classification and Flow of Resources

¹ Oil and gas exploration is, in general, an exception to this rule due to the pressure to find new sources of these minerals which, in effect, progressively reduces the margin between discovered **reserves** and those (undiscovered) inferred/speculative resources.

Source:

Adapted from Energy, Mines and Resources Canada, *A Summary View of Canadian Reserves and Additional Resources of Nickel, Copper, Zinc, Lead and Molybdenum*, Mineral Bulletin MR 169, 1977.

Table 4.1.8
Production and Reserves¹ of Metallic Minerals by Ecozone, 1981

Ecozone	Iron Ore		Copper		Nickel		Lead		Zinc	
	Production	Reserves²	Production	Reserves	Production	Reserves	Production	Reserves	Production	Reserves
	thousands of tonnes									
Atlantic Maritime	0	0	16 789	666 400	0	0	80 089	4 315 100	234 083	10 571 100
Nova Scotia	0	0	0	0	0	0	11 716	128 700	5 475	140 300
New Brunswick	0	0	12 034	666 400	0	0	68 373	4 186 400	228 608	10 430 800
Québec	0	0	4 755	..	0	0	0	0	0	0
Boreal Shield	22 870	1 766 000	368 162	10 664 900	160 247	8 304 400	6 617	288 000	377 758	7 785 800
Newfoundland	0	0	5 154	10 500	0	0	2 749	21 800	39 971	179 700
Québec	17 449	1 402 000	85 153	1 430 600	0	0	2	200	53 200	738 400
Ontario	5 421	364 000	225 838	8 120 700	130 268	5 933 400	3 386	246 000	246 027	5 988 300
Manitoba	0	0	47 061	1 063 100	29 979	2 371 000	480	20 000	31 828	848 800
Saskatchewan	0	0	4 956	40 000	0	0	0	0	6 732	30 600
Boreal Plain	0	0	8 922	..	0	0	0	0	7 713	0
Manitoba	0	0	8 922	..	0	0	0	0	7 713	0
Saskatchewan	0	0	0	0	0	0	0	0	0	0
Montane Cordillera	69	--	225 750	4 524 400	0	0	77 855	2 157 900	65 410	2 981 500
British Columbia	69	--	225 750	4 524 400	0	0	77 855	2 157 900	65 410	2 981 500
Pacific Maritime	533	10 000	62 334	934 700	0	0	2 487	11 500	13 800	78 500
British Columbia	533	10 000	62 334	943 700	0	0	2 487	11 500	13 800	78 500
Boreal Cordillera	0	0	9 094	23 400	0	0	55 985	1 455 500	78 810	2 213 500
British Columbia	0	0	0	--	0	0	15	0	4	0
Yukon	0	0	9 094	23 400	0	0	55 970	1 455 500	78 806	2 213 500
Tundra Cordillera	0	0	0	7 400	0	0	0	156 200	0	193 500
Northwest Territories	0	0	0	7 400	0	0	0	156 200	0	193 500
Taiga Plain	0	0	0	0	0	0	38 486	0	74 079	0
Saskatchewan	0	0	0	0	0	0	0	0	0	0
Alberta	0	0	0	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0	38 486	0	74 079	0
Taiga Shield	26 079	2 745 000	277	400	0	0	0	1 698 800	0	5 221 900
Newfoundland	25 686	2 655 000	0	0	0	0	0	0	0	0
Québec	393	90 000	0	0	0	0	0	0	0	0
Northwest Territories	0	0	277	400	0	0	0	1 698 800	0	5 221 900
Southern Arctic	0	0	0	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0	0	0	0	0
Northern Arctic	0	0	0	0	0	0	7 037	35 900	59 525	390 000
Northwest Territories	0	0	0	0	0	0	7 037	35 900	59 525	390 000
Canada	49 551	4 521 000	691 328	16 830 600	160 247	8 304 400	268 556	10 118 900	911 178	29 435 800
Ecozone	Molybdenum		Uranium		Silver		Gold			
	Production	Reserves	Production³		Production	Reserves	Production	Reserves		
	tonnes									
Atlantic Maritime	0	8 600	0		196	11 393	2.0	30.0		
Nova Scotia	0	0	0		1	4	0.0	0		
New Brunswick	0	8 600	0		193	11 389	2.0	30.0		
Québec	0		0		2	0	0.0	0		
Boreal Shield	926	25 000	4 850		416	12 002	37.2	812.6		
Newfoundland	0	0	0		7	40	0.2	0.6		
Québec	926	25 000	0		56	1 103	17.3	149.1		
Ontario	0	0	4 850		325	10 117	18.2	298.0		
Manitoba	0	0	0		22	707	1.2	362.9		
Saskatchewan	0	0	0		6	35	0.3	2.0		
Boreal Plain	0	0	2 497		4	0	0.1	0		
Manitoba	0	0	0		4	0	0.1	0		
Saskatchewan	0	0	2 497		0	0	0.0	0		
Montane Cordillera	13 590	374 700	0		339	7 008	3.8	116.3		
British Columbia	13 590	374 700	0		339	7 008	3.8	116.3		

Table 4.1.8
Production and Reserves¹ of Metallic Minerals by Ecozone, 1981 (concluded)

Ecozone	Molybdenum		Uranium	Silver		Gold	
	Production	Reserves	Production ³	Production	Reserves	Production	Reserves
tonnes							
Pacific Maritime	3 307	141 800	0	42	436	2.7	49.7
British Columbia	3 307	141 800	0	42	436	2.7	49.7
Boreal Cordillera	0	0	0	80	2 258	1.4	11.7
British Columbia	0	0	0	5	59	0.8	4.8
Yukon	0	0	0	75	2 199	0.6	6.9
Tundra Cordillera	0	0	0	0	275	0.0	0
Northwest Territories	0	0	0	0	275	0.0	0
Taiga Plain	0	0	375	0	41	0.0	0
Saskatchewan	0	0	375	0	0	0.0	0
Alberta	0	0	0	0	0	0	0
Northwest Territories	0	0	0	0	41	0.0	0
Taiga Shield	0	0	0	33	0	4.8	55.5
Newfoundland	0	0	0	0	0	0.0	0
Québec	0	0	0	33	0	4.8	55.5
Northwest Territories	0	0	0	0	0	0.0	0
Southern Arctic	0	0	0	0	0	0	20.7
Northwest Territories	0	0	0	0	0	0	20.7
Northern Arctic	0	0	0	0	201	0	0
Northwest Territories	0	0	0	0	201	0	0
Canada	17 553	550 100	7 722	1 110	33 614	52.0	1 096.5

Footnotes:

¹ Current estimates of reserves at existing or planned and committed mining operations are a small part of Canada's discovered resources.

² Reserves containing iron refer to the year 1976. Iron ore in Canadian deposits contains anywhere from thirty to fifty percent iron. Reserves of iron are so vast in relation to production that the figures presented here are considered to be approximate.

³ Measured and indicated reserves of uranium in 1982, assuming a price of up to \$115 per kilogram, were estimated by Energy, Mines and Resources Canada to be 185,000 tonnes. No ecozone breakdown can be given for reasons of data confidentiality.

Sources:

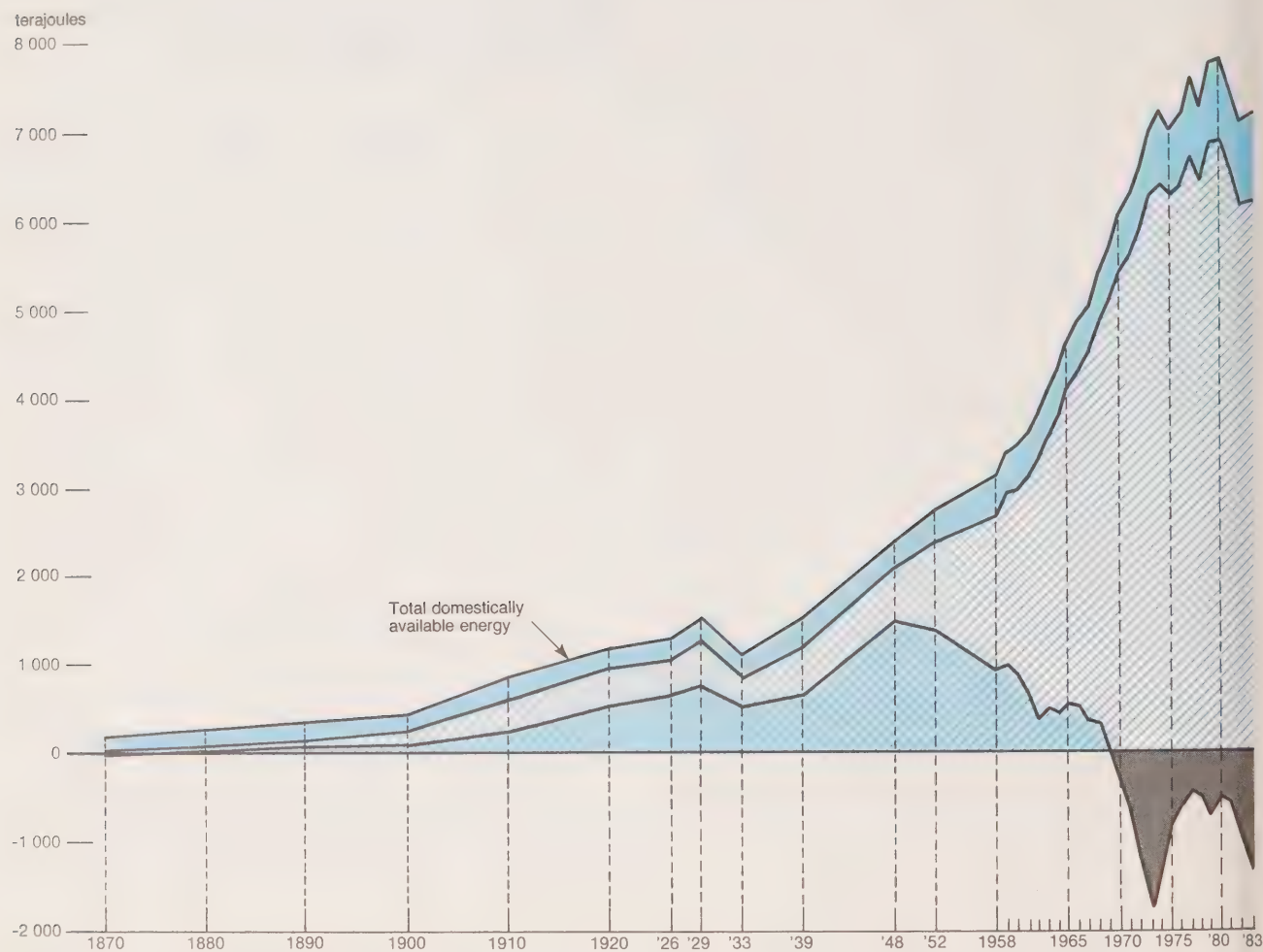
Energy, Mines Resources Canada, Annual Census of Metal Mines, 1981.
 Energy, Mines and Resources Canada, *Canadian Reserves as of January 1, 1981*, MR 191, 1982.
 Energy, Mines and Resources Canada, *A Summary View of Canadian Reserves and Additional Resources of Iron Ore*, MR 170, 1977.
 Statistics Canada, Office of the Senior Adviser on Integration, special tabulation.

4.2

Fossil Fuels



Chart 4.2.1
Domestically Available Energy and Net Energy Imports, 1870 to 1983¹



¹ The top line shows total domestically available energy and is always measured from the zero baseline. Wood fuel is excluded beginning with 1974.

Sources:

Statistics Canada, *Human Activity and the Environment*, Catalogue 11-509, 1978.

Statistics Canada, *Detailed Energy Supply and Demand in Canada*, Catalogue 57-207.

Statistics Canada, *Quarterly Report on Energy-Supply Demand in Canada*, Catalogue 57-003, fourth quarter issues for years 1978 to 1983.

Table 4.2.2
Consumption of Energy¹ by Fuel Type, 1870 to 1983

	1870	1900	1926	1948	1958	1971	1976	1981	1983
	percent								
Aviation Gasoline	...	...	..	..	0.7	0.1	0.1	0.1	0.1
Aviation Turbo Fuel	...	...	...	...	0.8	1.8	2.1	2.7	2.5
Liquefied Petroleum Gases	...	...	...	0.2	0.8	1.5	1.5	1.0	1.3
Coke Oven Gas	...	...	1.4	1.8	0.9	0.8	0.8	0.7	0.7
Coke	...	...	4.1	2.5	3.2	2.5	2.5	2.3	2.4
Petroleum Coke	...	...	0.1	0.1	1.0	0.5	0.7	0.1	0.1
Motor Gasoline	...	...	4.0 ²	11.2 ²	18.0	18.1	19.1	21.6	20.9
Electricity	...	0.3	3.2	7.7	11.6	13.8	15.8	19.4	21.5
Natural Gas	...	0.6	1.6 ³	3.1	11.1	24.9	26.3	25.4	27.4
Light Fuel Oil	...	...	..	..	11.5	11.5	9.9	7.3	5.9
Heavy Fuel Oil	...	...	..	..	11.4	13.0	10.0	7.6	5.2
Diesel Oil	...	...	5.4 ⁴	14.0 ⁴	4.9	5.9	6.8	9.4	9.7
Kerosene	0.5 ⁵	1.1 ⁵	..	..	3.8	2.4	1.4	0.8	0.6
Coal And Coal Briquettes	6.0 ⁶	52.5 ⁶	63.4	52.4	15.8	1.8	0.6	0.8	0.8
Steam	...	...	...	...	...	...	...	0.8 ⁷	0.9 ⁷
Wood	93.2	45.5	16.8	7.0	4.5	1.4	1.5	.. ⁸	.. ⁸
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Based on heat content of fuel and electricity actually consumed or "final demand". For example, electric energy derived both from coal and hydro power is shown as electricity, with that derived from coal included on the basis of heat content of electricity generated, not on the basis of heat content of coal consumed in generation. Figures for 1870 and 1900 are actually based on the heat content figures for domestically available primary energy products such as crude oil, coal and natural gas. For efficiency ratings of energy forms refer to Appendix 4, Table 1.

Includes naphtha and aviation fuel.

Includes manufactured gas.

Includes other petroleum fuels such as kerosene and fuel oils.

Based on heat content of domestic supply of crude oil. All crude oil prior to about 1910 was refined into kerosene, with other distillates rejected (See Davis Commission Report on Canadian Energy Prospects, 1957).

A substantial portion of early use of coal involved production of coal oil and coal gas for street lighting.

This is steam sold by the nuclear industry, and steam generated from coal and heavy fuel oil.

⁸ Wood has been excluded from the calculations in 1981 and 1983 due to lack of data. The few survey results that are available suggest that the consumption of both cordwood and wood residuals (sawdust, chips and bark, for example) may have increased since the rise in prices of fossil fuels in 1973. For example, one study estimates 1982 cordwood consumption in New Brunswick to be 4.2 percent of the province's estimate of total energy consumption. Wood residuals represented another 9.1 percent of the total. Wood consumption in Ontario was estimated to be 2.2 percent of Statistics Canada's estimate of total energy use (excluding wood) for that province. The provincial sources are: New Brunswick, Energy Secretariate, *New Brunswick Energy Review*, 1983 and Ontario, Ministry of Energy, *Ontario Energy Review*, 3rd Edition, September, 1983.

Sources:

M.C. Urquhart and K.A.H. Buckley, ed., *Historical Statistics Canada*, Toronto, Macmillan of Canada, 1965; and the following publications of Statistics Canada: *Energy Sources in Canada, Commodity Accounts for 1948 and 1952*, Catalogue 13-506; *Energy Sources in Canada, Commodity Statements for 1926, 1929, 1933 and 1939*, Catalogue 13-507; *Detailed Energy Supply in Canada, 1958-1969*, Catalogue 57-505; *Detailed Energy Supply in Canada, 1972 and 1976 issues*, Catalogue 57-207; and *Quarterly Report on Energy Supply-Demand in Canada*, Catalogue 57-003 (fourth quarter issues for 1981 and 1983).

Table 4.2.3
Consumption of Energy by Sector and Fuel Type, 1983¹

	Coal, Coke and Coke Oven Gas	Motor Gasoline	Diesel Fuel Oil	Light Fuel Oil	Heavy Fuel Oil	Aviation Gasoline and Turbo Fuel	Other Petroleum Derivatives ²	Natural Gas and Gas Plant Liquids	Electricity	Steam	Total
	térajoules										
Energy Supply											
Industry	148	996	3 308	2 842	49 739	37	143 844	4 124	110 493	0	315 531³
Transportation	0	1 001 024	266 073	0	56 213	116 383	0	58 754	8 612	0	1 507 060
Road Transport and Urban Transport	0	1 001 024	150 750	0	0	0	0	6 493	2 910	0	1 161 289
Rail	0	0	77 716	0	1 617	0	0	0	0	0	79 334
Air	0	0	0	0	0	116 383	0	0	0	0	116 383
Marine ⁴	0	0	34 575	0	54 596	0	0	0	0	0	89 171
Pipelines	0	0	3 032	0	0	0	0	52 261	5 702	0	60 884
Agriculture	0	75 705	73 680	41 858	1 066	0	3 726	20 550	29 798	0	246 383
Residential	3 241	0	0	180 625	5 334	0	20 349	483 104	345 108	0	1 037 760
Commercial and Institutional	762	58 695	52 388	61 885	45 557	13 678	5 988	383 384	257 660	781	880 777
Public											
Administration	352	14 760	27 592	16 122	4 121	16 121	1 509	20 465	32 641	0	133 683
Industrial	210 741	0	113 328	26 334	173 386	0	8 540	613 926	513 153	49 862	1 709 267
Total	215 244	1 151 180	536 369	329 666	335 416	146 219	183 956	1 584 307	1 297 465	50 643	5 830 461

A table similar to this for the year 1973, appeared in *Human Activity and the Environment*, Catalogue 11-509, 1978.

Includes liquefied petroleum gases, still gas, kerosene, and petroleum coke.

Non-energy products are not included in this total.

Does not include Arméd Forces equipment.

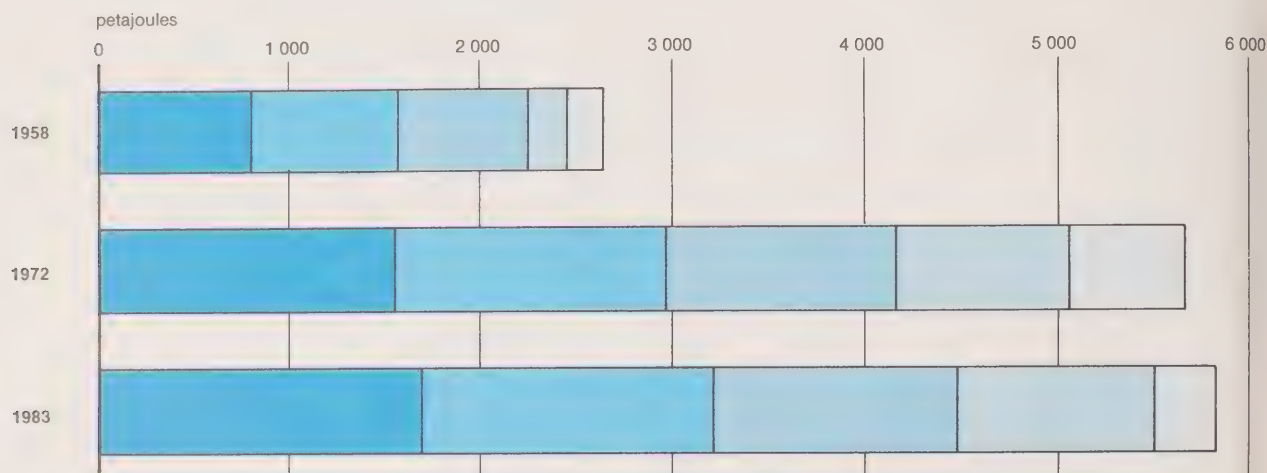
Source:

Statistics Canada, *Quarterly Report on Energy Supply - Demand in Canada*, Catalogue 57-003, 1983 fourth quarter issue.

Note:

Individual items may not add to total due to rounding.

Chart 4.2.4

Energy Consumed by Sector, 1958, 1972 and 1983**Sources:**

Statistics Canada, *Detailed Energy Supply and Demand in Canada*, Catalogue 57-207, 1958-1969 and 1972.

Statistics Canada, *Quarterly Report on Energy Supply - Demand in Canada*, Catalogue 57-003, 1983-IV.

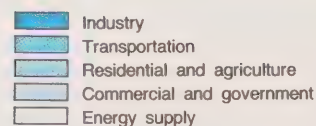
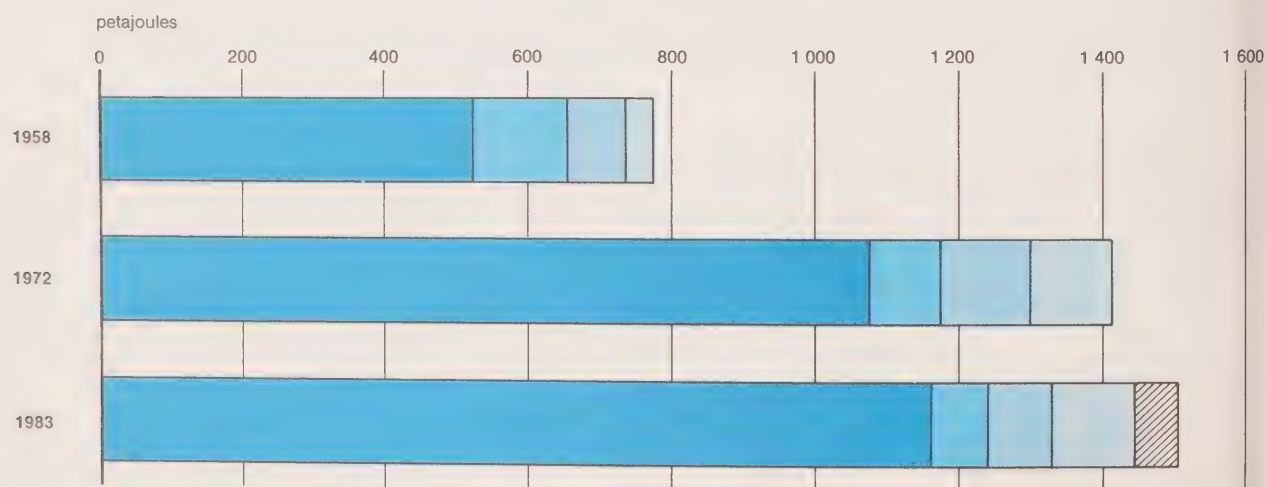


Chart 4.2.5

Energy Consumed in the Transportation Sector, by Mode of Transport, 1958, 1972 and 1983**Sources:**

Statistics Canada, *Detailed Energy Supply and Demand in Canada*, Catalogue 57-207, 1958-1969 and 1972.

Statistics Canada, *Quarterly Report on Energy Supply - Demand in Canada*, Catalogue 57-003, 1983-IV.

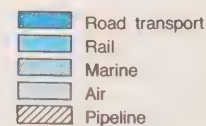


Table 4.2.6
Energy Consumption by Ecozone and Sector, 1982¹

Ecozone	Agriculture	Forestry	Mining	Construction	Manufacturing
petajoules					
Atlantic Maritime	7.9	1.1	12.8	3.3	108.0
Mixed-Wood Plain	55.4	0.5	0.4	13.5	765.1
Boreal Shield	5.0	8.7	53.5	2.8	223.2
Prairie	76.6	0.1	37.6	12.2	165.1
Boreal Plain	21.8	2.2	37.7	2.1	29.5
Montane Cordillera	3.8	6.5	46.8	1.1	59.6
Pacific Maritime	3.3	1.2	4.9	2.9	103.2
Boreal Cordillera	<0.1	1.4	3.1	0.1	<0.1
Fundra Cordillera	0	0.1	0.7	<0.1	0
Taiga Plain	<0.1	0.3	1.9	0.1	0.4
Taiga Shield	0	0.2	18.0	0.1	<0.1
Hudson Bay Plain	0	0.1	<0.1	<0.1	<0.1
Southern Arctic	0	<0.1	<0.1	0.1	0
Northern Arctic	0	0	0.5	0.1	0
Arctic Cordillera	0	0	<0.1	0.1	0
Total²	173.8	22.4	217.9	38.3	1 454.2

Ecozone	Transportation	Residential	Public Administration, Commercial and Other Institutional	Total
petajoules				
Atlantic Maritime	118.7	79.8	67.9	399.5
Mixed-Wood Plain	727.8	566.3	481.0	2 610.0
Boreal Shield	143.7	123.3	88.2	648.4
Prairie	304.2	214.6	244.3	1 054.6
Boreal Plain	56.9	48.1	40.0	238.3
Montane Cordillera	49.4	31.8	30.3	229.3
Pacific Maritime	162.0	74.1	85.7	437.3
Boreal Cordillera	2.5	1.3	3.3	11.8
Fundra Cordillera	0.1	<0.1	0.2	1.1
Taiga Plain	1.1	0.6	2.1	6.5
Taiga Shield	4.7	2.8	3.2	29.0
Hudson Bay Plain	1.1	0.7	0.8	2.8
Southern Arctic	1.0	0.6	1.7	3.4
Northern Arctic	0.7	0.4	1.4	3.0
Arctic Cordillera	0.1	<0.1	0.1	0.3
Total²	1 574.0	1 144.5	1 050.2	5 675.3

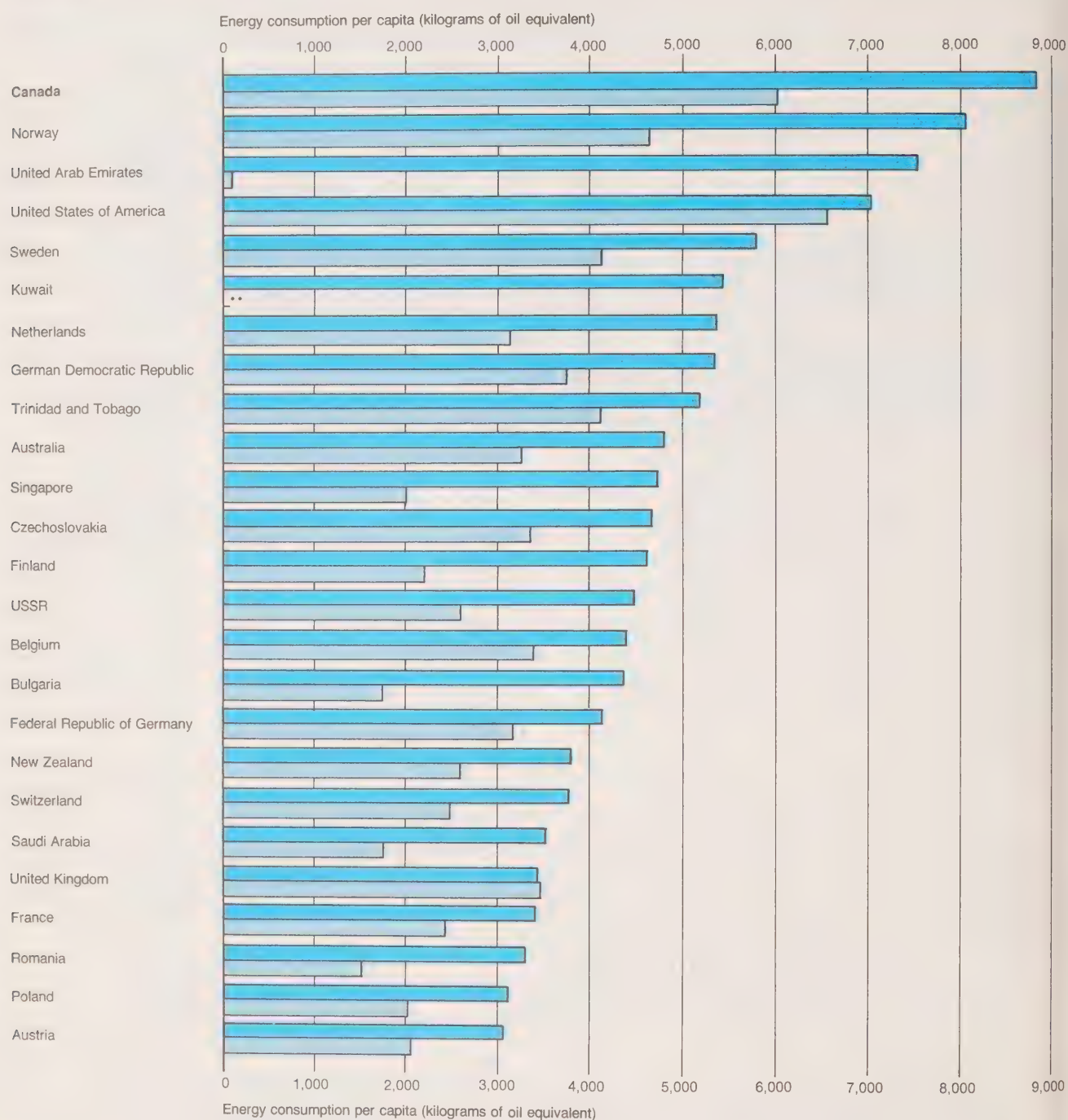
The published "energy final demand" figures, by province and sector, were disaggregated by ecozone using a number of allocation factors, such as the proportional distribution of population and industry by ecozone within in each province.

This table presents final demand energy use only, and as a result is not strictly comparable with Table 4.2.3 and Chart 4.2.4. These also take into account consumption of energy by thermal power plants in the course of operations, such as boiler start up and certain non-energy uses of refined products.

Source:

Statistics Canada, *Quarterly Report on Energy Supply-Demand in Canada, 1982-IV*, Catalogue 57-003, and estimates by the Office of the Senior Advisor on Integration, Statistics Canada.

Chart 4.2.7

Energy Consumption per Capita in Selected Countries¹, 1965 and 1983

¹ This list includes the countries with the highest energy consumption per capita.

Source:
World Bank, *World Development Report 1985*

■ 1983
■ 1965

Table 4.2.8
Fossil Fuel Production and Consumption, 1868 to 1982

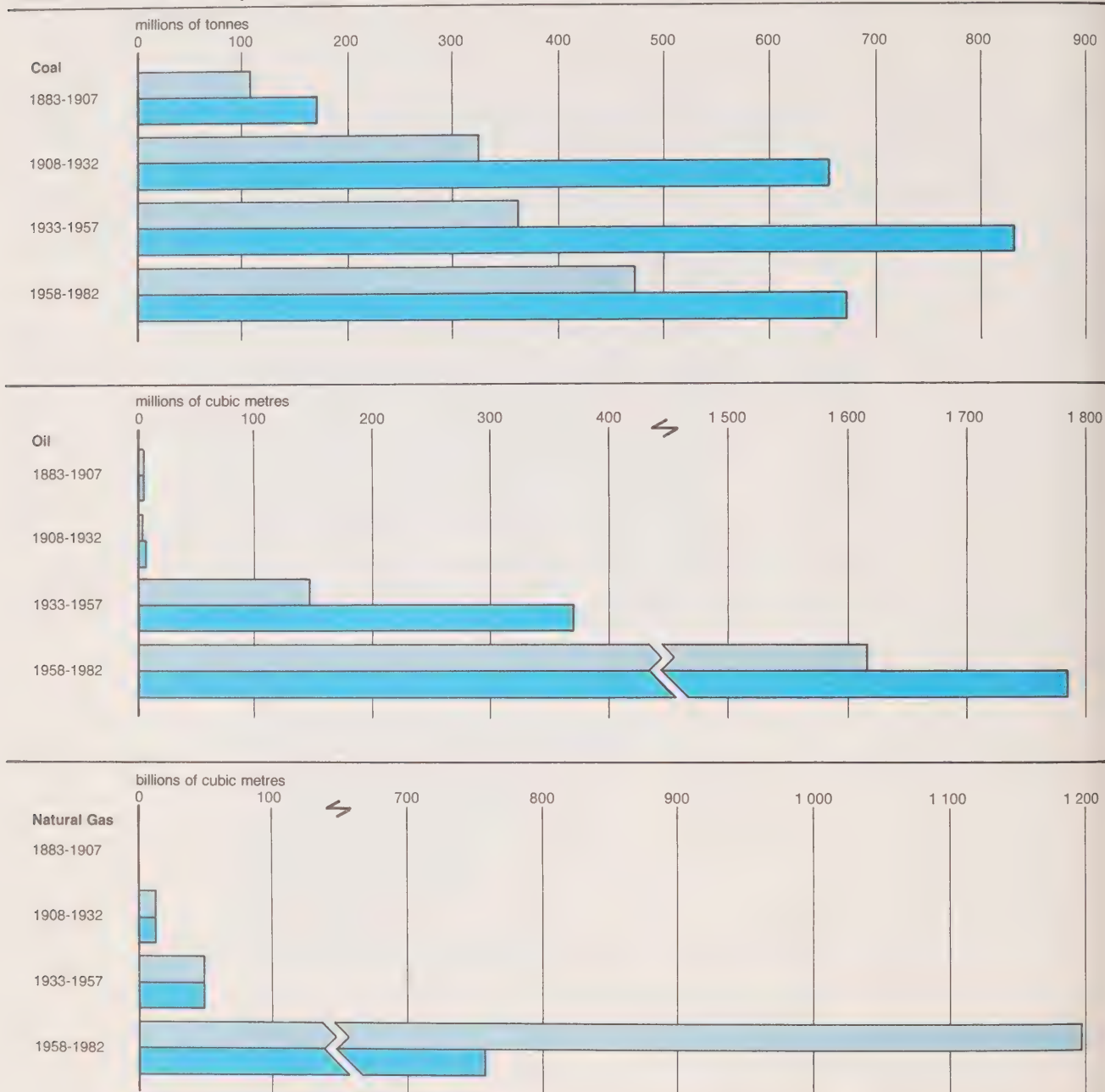
Five Year Period	Production over Five Year Period			Consumption Expressed as Percentage of Production		
	Coal	Oil	Natural Gas	Coal	Oil	Natural Gas
	thousands of tonnes	thousands of cubic metres	millions of cubic metres	percent		
1868-1872	4 624	197	..	100	100	..
1873-1877	3 743	219	..	60	107	..
1878-1882	6 427	317	..	122	147	..
1883-1887	9 318	466	..	172	116	..
1888-1892	13 801	593	..	166	118	..
1893-1897	16 910	603	..	158	127	..
1898-1902	26 152	545	..	149	109	..
1903-1907	40 966	474	..	165	159	..
1908-1912	54 551	286	763	184	579	100
1913-1917	63 908	170	3 265	207	312	100
1918-1922	68 999	176	2 429	204	483	100
1923-1927	70 460	239	2 504	208	482	101
1928-1932	67 063	930	3 675	203	242	100
1933-1937	64 107	1 343	3 733	188	206	100
1938-1942	76 790	6 977	5 643	204	567	100
1943-1947	77 177	6 960	6 755	256	775	101
1948-1952	81 134	27 265	10 064	244	328	102
1953-1957	65 210	104 957	24 426	241	152	102
1958-1962	48 506	159 593	74 120	219	135	74
1963-1967	50 315	237 357	145 812	229	112	62
1968-1972	70 222	365 647	259 905	187	95	59
1973-1977	135 288	428 848	354 439	109	105	61
1978-1982	169 127	425 417	364 756	102	120	67
Total	1 284 798	1 769 579	1 262 289	182	125	65

Sources:

Statistics Canada, *Historical Statistics of Canada*, 2nd Edition, 1983.Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, years 1976 to 1982.

Chart 4.2.9

Production and Consumption of Fossil Fuels, Twenty-five Year Periods, 1883 to 1982



Sources:

Statistics Canada, *Historical Statistics of Canada*, 2nd Edition, 1983.Statistics Canada, *Canada's Mineral Production*, Catalogue 26-202, various years.

Production
Consumption

Table 4.2.10
Estimated Reserves of Conventional Crude Oil, 1960 to 1984¹

Year	Initial Reserves ²	Cumulative Production ³	Remaining Reserves ⁴	Annual Production	Discoveries, Revisions ⁵
millions of cubic metres					
1960	1 747	228	1 519	..	..
1961	1 754	263	1 491	35	7
1962	1 778	301	1 476	38	24
1963	1 806	342	1 464	41	28
1964	1 857	386	1 471	44	51
1965	1 960	432	1 528	46	103
1966	2 039	488	1 550	56	79
1967	2 154	544	1 611	55	115
1968	2 258	603	1 655	59	104
1969	2 325	665	1 659	62	67
1970	2 349	737	1 612	72	24
1971	2 388	814	1 573	77	39
1972	2 407	893	1 514	79	19
1973	2 417	996	1 421	103	10
1974	2 414	1 093	1 320	97	-3
1975	2 209	1 180	1 029	87	-205 ⁶
1976	2 207	1 253	954	73	-2
1977	2 246	1 327	919	73	39
1978	2 265	1 399	866	72	19
1979	2 288	1 480	808	81	23
1980	2 314	1 555	760	75	26
1981	2 336	1 621	716	66	22
1982	2 421	1 685	736	64	85
1983	2 471	1 752	719	67	50
1984	2 551	1 827	724	74	80

¹ Only reserves in conventional producing areas are included. Major exploration activities are underway in Arctic and Atlantic offshore locations. Discoveries are not included here because, as of date of compilation, their economic viability had not been demonstrated.

² Initial reserves are the total discovered recoverable reserves as of December 31 of the year indicated.

³ Cumulative production is the total quantity of crude oil produced from the first year of production until December 31 of the year indicated.

Remaining reserves are the difference of initial reserves minus cumulative production.

⁴ The sum of discoveries and revisions can be either a positive or negative value and is based on new information regarding the previous years' estimate of initial reserves. The value is added to, or subtracted from (if negative), the previous years' estimate of initial reserves to obtain the current year's estimate of initial reserves.

⁵ This large number is the result of a change in the method of estimation of reserves introduced by the National Energy Board in 1975.

Sources:

Canadian Petroleum Association, *Statistical Yearbook*, 1982.

National Energy Board, *Annual Reports*, years 1975 to 1984.

Table 4.2.11
Estimated Reserves of Natural Gas, 1960 to 1984¹

Year	Initial Reserves ²	Cumulative Production ³	Remaining Reserves ⁴	Annual Production	Discoveries, Revisions ⁵
billions of cubic metres					
1960	1 008	83	925	..	..
1961	1 058	98	960	15	50
1962	1 167	118	1 049	20	109
1963	1 238	143	1 095	25	71
1964 ⁶	1 359	168	1 332	25	121
1965	1 462	200	1 262	29	104
1966	1 515	231	1 284	31	53
1967	1 629	266	1 363	35	113
1968	1 719	305	1 414	39	91
1969	1 895	354	1 541	49	176
1970	1 966	404	1 562	50	171
1971	2 110	464	1 646	60	143
1972	2 124	529	1 595	66	15
1973	2 235	600	1 635	71	110
1974	2 293	670	1 623	70	158
1975	2 341	739	1 602	69	48
1976	2 471	804	1 667	65	130
1977	2 637	876	1 761	72	166
1978	2 852	944	1 908	68	215
1979	2 983	1 027	1 956	69	130
1980	3 066	1 096	1 970	69	83
1981	3 257	1 173	2 084	77	191
1982	3 349	1 245	2 104	71	92
1983	3 385	1 316	2 069	71	36
1984	3 418p	1 397p	2 021	75	34

Only reserves in conventional producing areas are included. Major exploration activities are under way in Arctic and Atlantic offshore locations. Discoveries are not included here because as of the date of compilation their economic viability had not been demonstrated.

Initial reserves are the total discovered recoverable reserves as of December 31 of the year indicated.

Cumulative production is the total quantity of gas produced from the first year of production until December 31 of the year indicated.

Remaining reserves are the difference between initial reserves minus cumulative production.

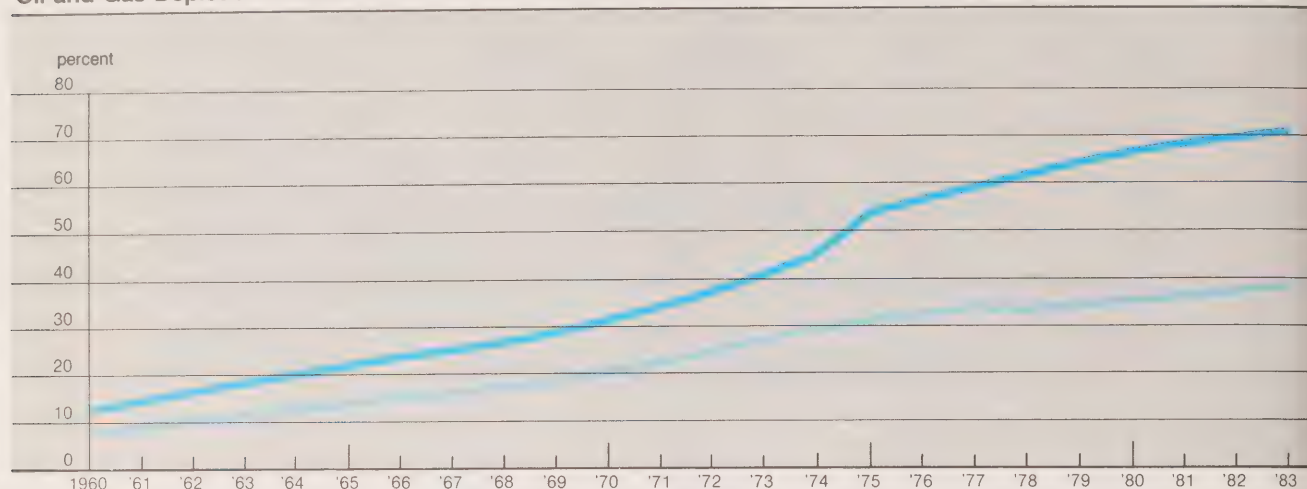
⁵ The sum of discoveries and revisions can be either a positive or a negative value and is based on new information regarding the previous years' estimate of initial reserves. The value is added to, or subtracted from (if negative), the previous years' estimate of initial reserves.

⁶ A new method of estimating reserves was introduced in 1964.

Source:

National Energy Board, unpublished estimates.

Chart 4.2.12
Oil and Gas Depletion Indices¹



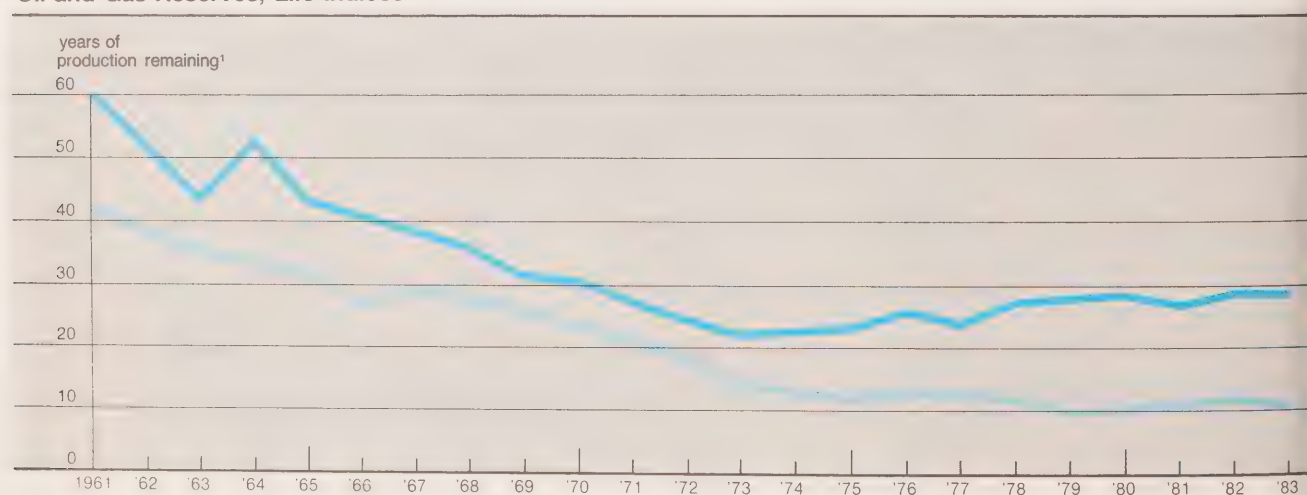
¹ The Depletion Index measures the percentage of initial reserves that are depleted. Specifically, it is the ratio of cumulative production to initial reserves multiplied by 100. For definitions and source statistics refer to Tables 4.2.10 and 4.2.11.

Sources:

National Energy Board and the Petroleum Association of Canada. Additional calculations by the Office of the Senior Adviser on Integration.

Oil
Gas

Chart 4.2.13
Oil and Gas Reserves, Life Indices

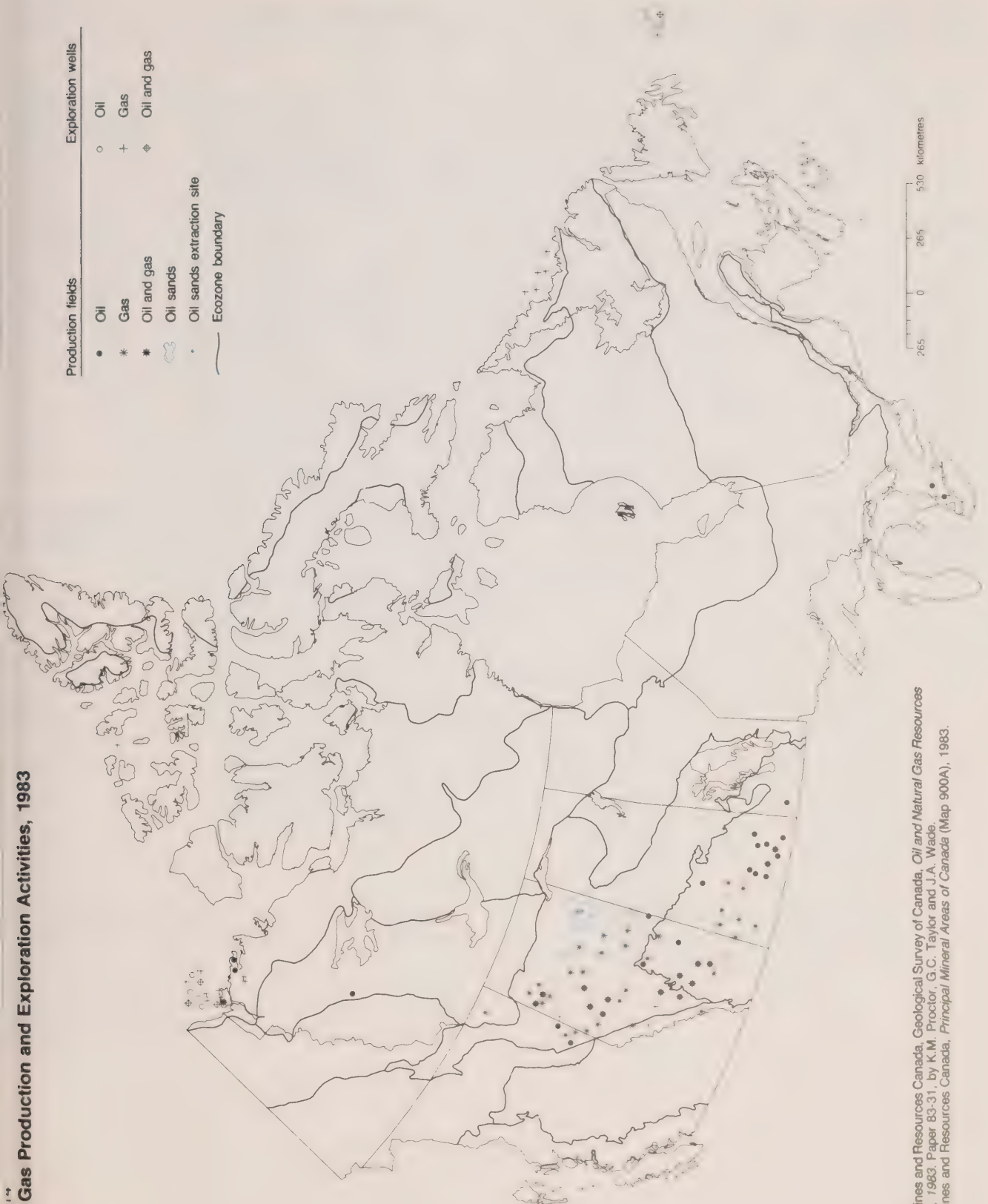


¹ The reserves life index is a measure of the remaining years of production, assuming current rates of extraction. It is the remaining reserves divided by the annual production. For definitions and source statistics refer to Tables 4.2.10 and 4.2.11.

Sources:

National Energy Board and Petroleum Association of Canada. Additional calculations by the Office of the Senior Adviser on Integration.

Gas
Oil



Sources:
 Energy, Mines and Resources Canada, Geological Survey of Canada, *Oil and Natural Gas Resources of Canada*, 1983, Paper 83-31, by K.M. Proctor, G.C. Taylor and J.A. Wade
 Energy, Mines and Resources Canada, *Principal Mineral Areas of Canada* (Map 900A), 1983.

Table 4.2.15
Estimated Reserves of Conventional Oil by Ecozone, as of December 31, 1981

Ecozone	Crude Oil								
	Initial Reserves			Cumulative Production			Remaining Reserves		
	Total	Light and Medium Crude	Heavy Crude	Total	Light and Medium Crude	Heavy Crude	Total	Light and Medium Crude	Heavy Crude
millions of cubic metres									
Mixed-Wood Plain	9.7	9.7	0	9.1	9.1	0	0.6	0.6	0
Ontario	9.7	9.7	0	9.1	9.1	0	0.6	0.6	0
Prairie	1 217.0	869.7	347.2	894.5	657.8	236.6	322.5	211.9	110.6
Manitoba	28.4	28.4	0	21.1	21.0	0	7.4	7.4	0
Saskatchewan	381.9	126.7	255.2	280.9	101.4	179.5	101.0	25.3	75.6
Alberta	806.7	714.6	92.0	592.5	535.4	57.1	214.1	179.2	35.0
Boreal Plain	1 186.6	1 183.0	3.6	696.0	694.6	1.4	490.6	488.4	2.2
Alberta	1 108.1	1 104.5	3.6	641.6	640.2	1.4	466.6	464.4	2.2
British Columbia	78.5	78.5	0	54.4	54.4	0	24.0	24.0	0
Taiga Plain	40.6	40.6	0	19.9	19.9	0	20.7	20.7	0
Alberta	31.1	31.1	0	15.7	15.7	0	15.3	15.3	0
Northwest Territories	9.5	9.5	0	4.2	4.2	0	5.4	5.4	0
Canada	2 453.9	2 103.0	350.9	1 619.4	1 381.4	238.1	834.4	721.6	112.8

Sources:

National Energy Board, *Staff Report on Crude Oil Reserves and Productive Capacity*, February, 1983.

Alberta Energy Conservation Board, *Alberta's Reserves of Crude Oil, Gas, Natural Gas Liquids and Sulphur*, 1981.

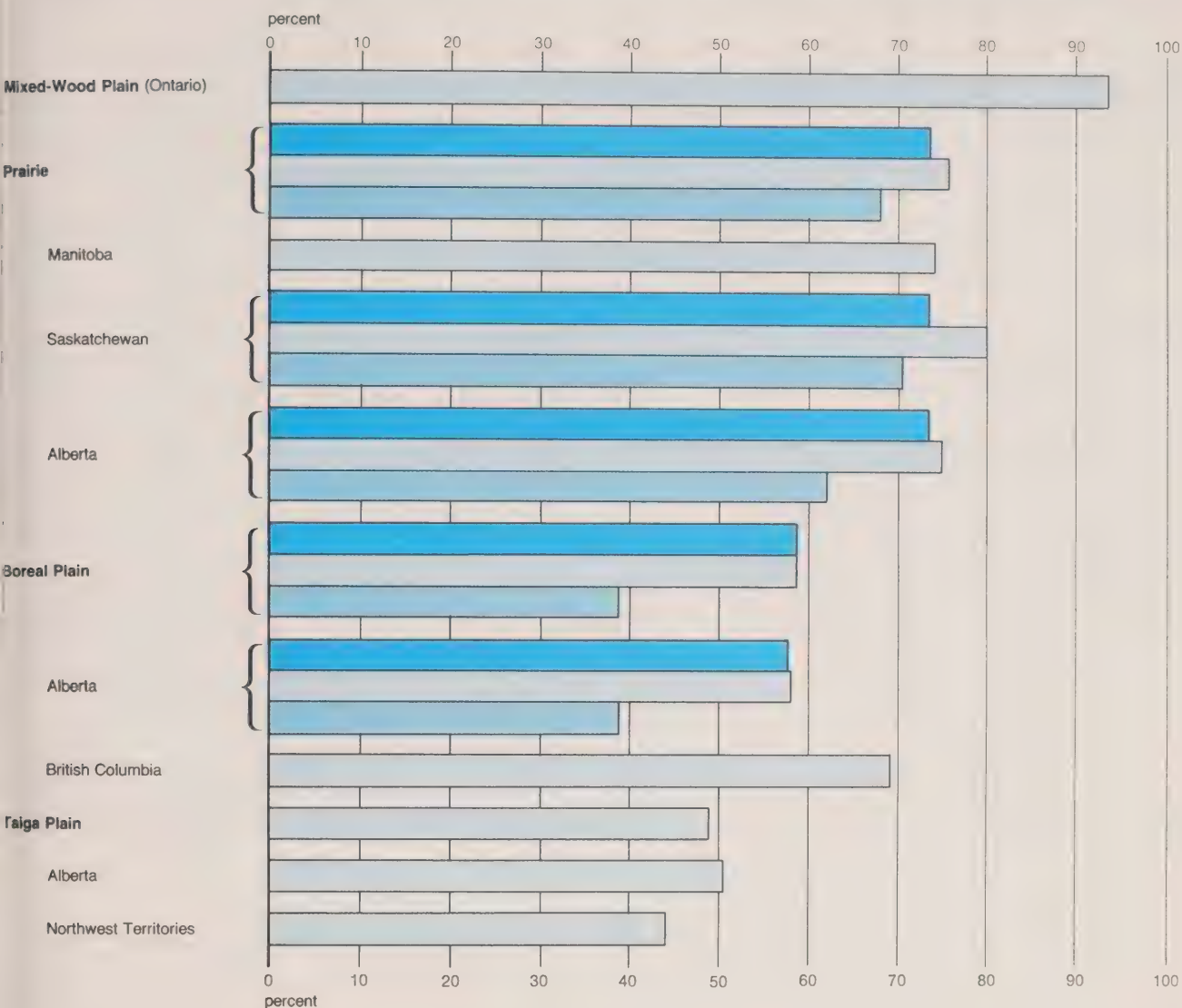
Special tabulations by the Office of the Senior Adviser on Integration.

Note:

These Canada totals differ from those in Table 4.2.10. Estimation methods employed by the National Energy Board were different from those of the Alberta Energy Conservation Board. The Alberta source, containing data disaggregated by field, had to be used to obtain the ecozone breakdown in that province.

Individual items may not add to totals due to rounding.

Chart 4.2.16
Oil Depletion Index by Ecozone, as of December 31, 1981¹



The depletion index measures the percentage of initial reserves that are depleted. Specifically, it is the ratio of cumulative production to initial reserves multiplied by 100. For source statistics refer to Table 4.2.15.

Sources:
National Energy Board, *Staff Report on Crude Oil Reserves and Productive Capacity*, February, 1983.
Alberta Energy Conservation Board, *Alberta's Reserves of Crude Oil, Gas, Natural Gas Liquids and Sulphur*, 1981.

Special tabulation and calculations by the Office of the Senior Adviser on Integration.

Legend:
Total
Light and medium crude
Heavy crude

Table 4.2.17
**Estimated Tar Sands Oil Reserves, Alberta
 Boreal Plain, as of December 31, 1981**

Overburden Depth	Synthetic Crude Oil			
	Initial Reserves	Cumulative Production	Remaining Reserves	Depletion Index ¹
	millions of cubic metres			percent
0-20 metres	1 670	34	1 636	2.0
21-40 metres	1 330	12	1 318	0.1
41-80 metres	820	0	820	0.0
81-120 metres	80	0	80	0.0
Total (0-120 metres)	3 900	46	3 854	1.2

¹ The depletion index measures the percentage of initial reserves that are depleted. Specifically, it is 100 multiplied by the ratio of cumulative production to initial reserves.

Source:
 Alberta Energy Conservation Board, *Alberta's Reserves of Crude Oil, Gas, Natural Gas, Liquids and Sulphur*, Report 82-18, 1981.

Note:

The Wabiskaw-McMurray oil sands field is the largest in Canada and the only one containing producing mines. No estimate of synthetic crude oil reserves for the Buffalo Head Hills, Cold Lake or Peace River Oil Sands fields are published. Large quantities of tar sands are known to occur below 120 metres but their economic viability has not yet been demonstrated.

Table 4.2.18
**Estimated Reserves of Natural Gas by Ecozone,
 as of December 31, 1981**

Ecozone	Marketable Gas		
	Initial Reserves	Cumulative Production	Remaining Reserves
	billions of cubic metres		
Mixed-Wood Plain	29.1	20.3	8.8
Ontario	29.1	20.3	8.8
Prairie	1 470.0	618.4	851.6
Saskatchewan	64.8	27.8	37.0
Alberta	1 405.2	590.6	814.6
Boreal Plain	1 567.2	500.0	1 067.2
Saskatchewan	5.1	1.9	3.2
Alberta	1 285.1	377.7	907.4
British Columbia	277.0	120.4	156.6
Taiga Plain	111.5	35.6	75.9
Alberta	8.8	0.5	8.3
British Columbia	87.5	29.6	57.9
Northwest Territories	15.2	5.5	9.7
Canada	3 177.8	1 174.3	2 003.5

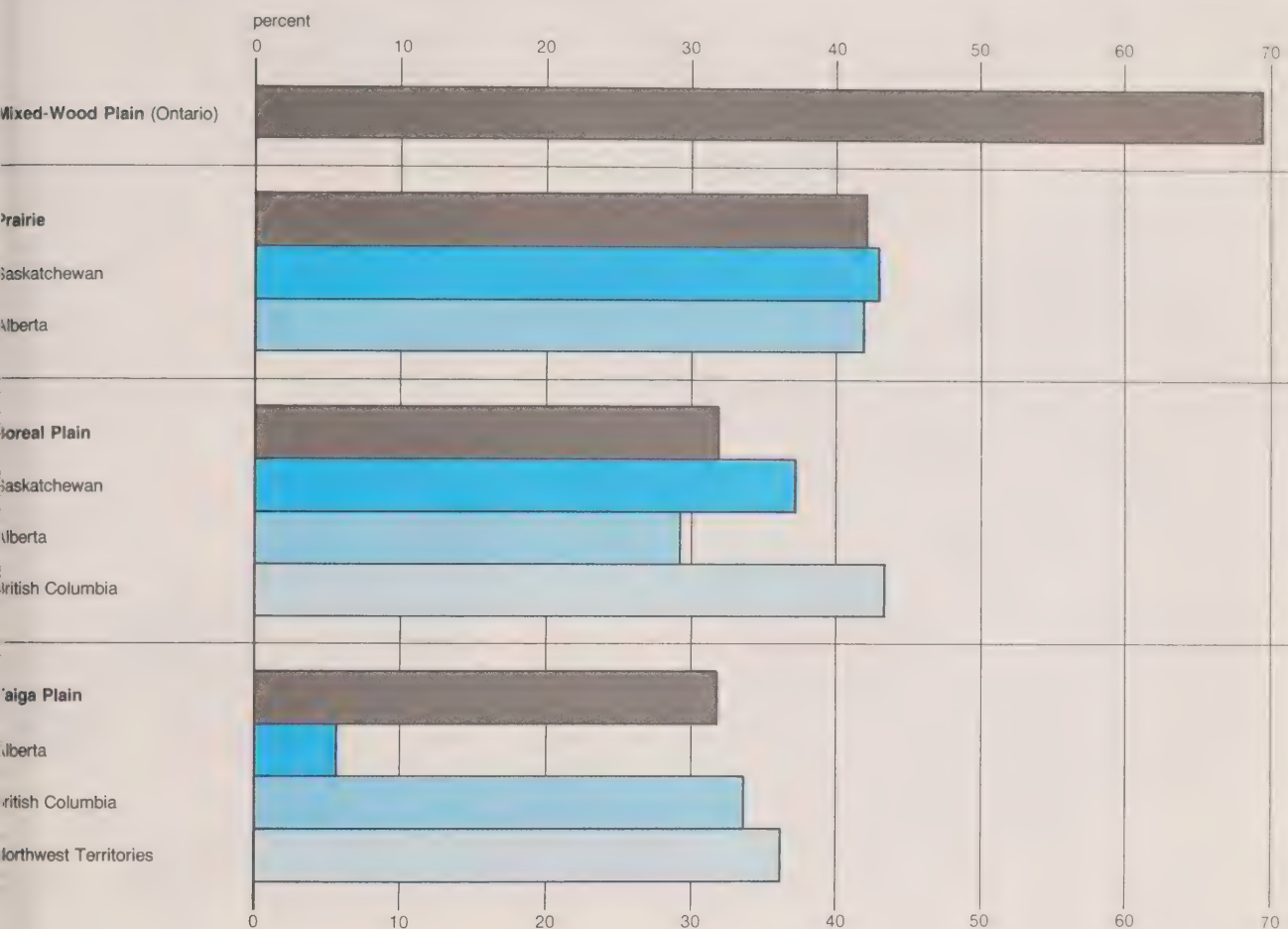
Sources:

National Energy Board, unpublished estimates.
 Alberta Energy Conservation Board, *Alberta's Reserves of Crude Oil, Gas, Natural Gas Liquids and Sulphur*, 1981.
 British Columbia Ministry of Energy, Mines and Petroleum Resources, *Hydrocarbon and Byproduct Reserves*, 1981.
 Saskatchewan Department of Energy, Mines and Resources, *Saskatchewan Reservoir Annual*, 1981.
 Special tabulation by the Office of the Senior Advisor on Integration.

Note:

These Canada totals differ from those in Table 4.2.11 because different estimation methods were employed by the source agencies, the National Energy Board and the Provincial Government Departments. The National Energy Board source could not be used to obtain disaggregations by ecozone because it contained no information for individual fields, only provincial totals.

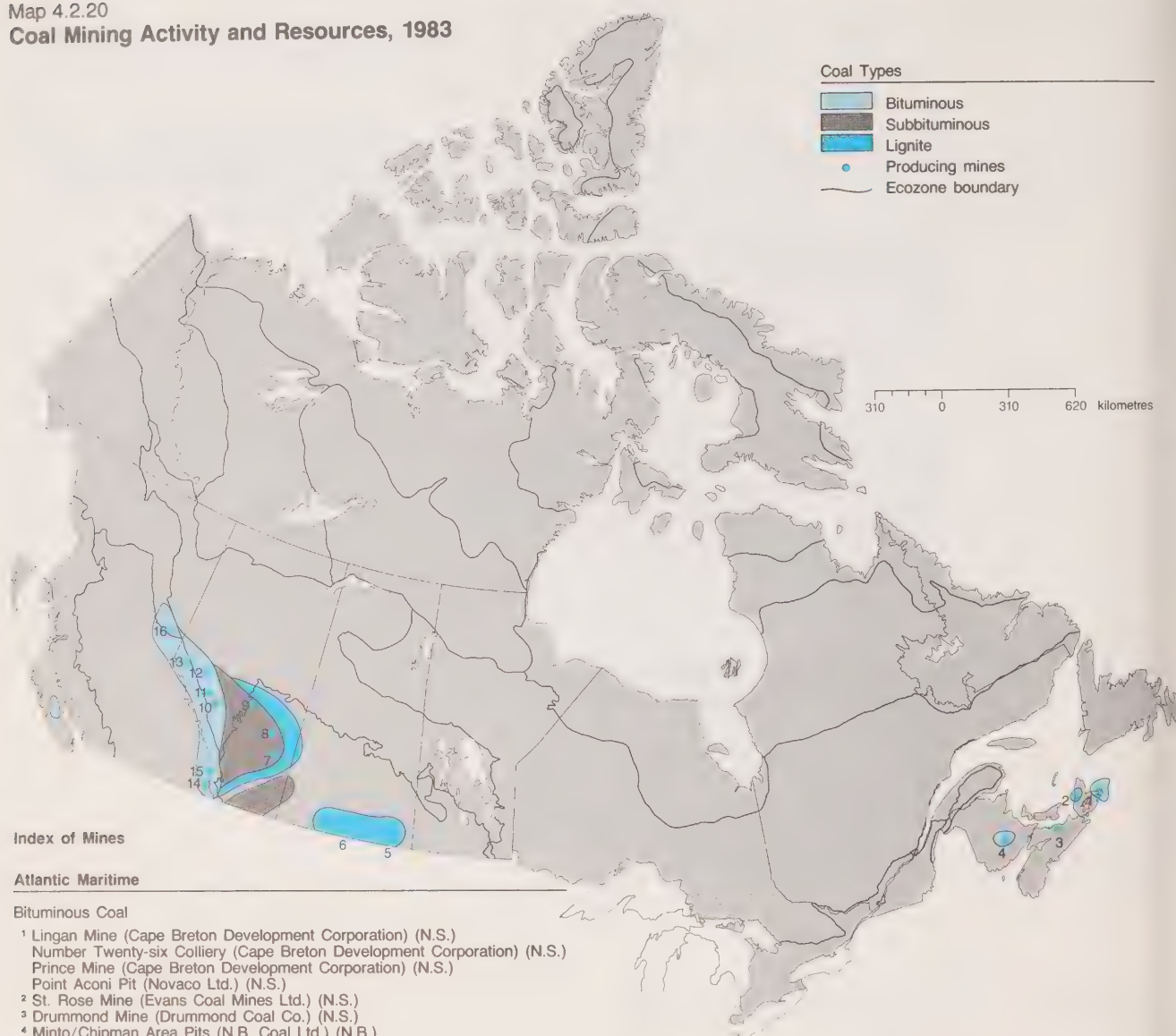
Chart 4.2.19
Natural Gas Depletion Index¹ by Ecozone, as of December 31, 1981



The depletion index measures the percentage of initial reserves that are depleted. Specifically, it is the ratio of cumulative production to initial reserves multiplied by 100. For source statistics refer to Table 4.2.18.

Sources:
 National Energy Board, unpublished estimates, 1983.
 Alberta Energy Conservation Board, *Alberta's Reserves of Crude Oil, Gas, Natural Gas Liquids and Sulphur*, 1981.
 British Columbia Ministry of Energy, Mines and Petroleum Resources, *Hydrocarbon and Byproduct Reserves*, 1981.
 Saskatchewan Department of Energy, Mines and Resources, *Saskatchewan Reserve Annual*, 1981.
 Special tabulation and calculations by the Office of the Senior Adviser on Integration.

Map 4.2.20
Coal Mining Activity and Resources, 1983



Index of Mines

Atlantic Maritime

Bituminous Coal

- ¹ Lingan Mine (Cape Breton Development Corporation) (N.S.)
- Number Twenty-six Colliery (Cape Breton Development Corporation) (N.S.)
- Prince Mine (Cape Breton Development Corporation) (N.S.)
- Point Aconi Pit (Novaco Ltd.) (N.S.)
- ² St. Rose Mine (Evans Coal Mines Ltd.) (N.S.)
- ³ Drummond Mine (Drummond Coal Co.) (N.S.)
- ⁴ Minto/Chipman Area Pits (N.B. Coal Ltd.) (N.B.)

Prairie

Lignite Coal

- ⁵ Biefait Mine (Biefait Coal Co.) (Sask.)
- Boundary Dam Mine (M & S Coal Co.) (Sask.)
- Costello Mine (formerly Klimax Mine) (Manalta Coal Ltd.) (Sask.)
- Souris Valley Mine (Saskatchewan Power Corporation) (Sask.)
- Utility Mine (Saskatchewan Power Corporation with Manalta as operator) (Sask.)
- ⁶ Poplar River Mine (Saskatchewan Power Corporation) (Sask.)

Subbituminous Coal

- ⁷ Montgomery Mine (formerly Roselyn Mine) (Manalta Coal Ltd.) (Alta.)
- ⁸ Vesta Mine (Alberta Power Limited with Manalta as operator) (Alta.)
- Diplomat Mine (Forestburg Collieries Ltd.) (Alta.)
- Paintearth Mine (Forestburg Collieries Ltd.) (Alta.)
- ⁹ Highvale Mine (TransAlta Utilities Corporation with Manalta as operator) (Alta.)
- Whitewood Mine (TransAlta Utilities Corporation with Manalta as operator) (Alta.)

Boreal Plain

Bituminous Coal

- ¹⁰ Coal Valley Mine (Luscar Sterco Ltd.) (Alta.)
- ¹¹ Luscar Mine (Cardinal River Coals Ltd.) (Alta.)
- Gregg River Mine (Manalta Coal Ltd.) (Alta.)
- ¹² Obed-Marsh Project (Union Oil Company of Canada Ltd.) (Alta.)

Montane Cordillera

Bituminous Coal

- ¹³ Number 1765 Mine (underground) (Smoky River Coals Ltd.) (Alta.)
- Number 1774 Mine (surface) (Smoky River Coals Ltd.) (Alta.)
- ¹⁴ Corbin Mine (Byron Creek Collieries Ltd.) (B.C.)
- Harmer Surface Mine (Westar Mining Ltd.) (B.C.)
- Michel Underground Mine (Westar Mining Ltd.) (B.C.)
- ¹⁵ Line Creek Mine (Crows Nest Resources Ltd.) (B.C.)
- Fording River Mine (Fording Coal Ltd.) (B.C.)
- Greenhills Mine (Westar Mining Ltd.) (B.C.)

Boreal Cordillera

Bituminous Coal

- ¹⁶ Quintette Mine (Denison Mines Ltd. and others) (B.C.)
- Bullmoose Mine (Teck Corporation and others) (B.C.)

Sources:

Energy, Mines and Resources Canada, *National Atlas of Canada, fifth edition, Canada Coal (Map)*, 1982.
Energy, Mines and Resources Canada, *Coal Mining in Canada, CANMET Report 83-20E*, 1984.

Table 4.2.21
Coal Reserves by Ecozone, 1982

Ecozone	Estimated Reserves of Recoverable Coal		
	Bituminous	Subbituminous	Lignite
	millions of tonnes		
Atlantic Maritime	463	0	0
Nova Scotia	445	0	0
New Brunswick	18	0	0
Prairie	0	397	1 697
Saskatchewan	0	0	1 697
Alberta	0	397	0
Boreal Plain	526	2	1
Alberta	526	2	1
Montane Cordillera	1 574	0	566
British Columbia	1 574	0	566
Pacific Maritime	15	0	0
British Columbia	15	0	0
Boreal Cordillera	509	0	0
British Columbia	509	0	0
Canada	3 087	399	2 264

Source:
Energy, Mines and Resources Canada, *Coal Mining in Canada: 1983*, by A.S. Romaniuk and H.G. Naidu, CANMET Report 83-20E, March, 1984, special tabulation by the Office of the Senior Adviser on Integration.

Table 4.2.22
Coal Production by Ecozone, 1981¹

	Method of Mining		Total
	Underground	Surface	
	thousands of tonnes		
Atlantic Maritime	3 029	922	3 951
Nova Scotia	3 029	351	3 380
New Brunswick	0	571	571
Prairie	0	9 948	9 948
Saskatchewan	0	7 494	7 494
Alberta	0	2 454	2 454
Boreal Plain	0	17 417	17 417
Alberta	0	17 417	17 417
Montane Cordillera	2 243	19 615	21 858
Alberta	1 064	3 716	4 780
British Columbia	1 179	15 899	17 078
Canada	5 272	47 902	53 174

¹ Coal production is defined here as net raw coal production: gross production plus (or minus) the net quantity dumped on or reclaimed from the discard heap. Raw coal includes impurities and therefore outweighs clean coal production, which was 40 082 000 tonnes in 1981: Statistics Canada, *Canadian Statistical Review*, Catalogue 11-003, December, 1983.

Source:
Statistics Canada, Annual Census Of Coal Mines, 1981, special tabulation by the Office of the Senior Adviser on Integration.

Table 4.2.23

Socio-Economic Profile of Persons Employed in the Mining and Oil Extraction Industry¹ by Ecozone, 1981

Ecozone	Total Employed ²		Full Time Employed ³						
	Persons	Average Income	Persons	Average Income	As a Percentage of Total Employed	Migrants	Percentage of Full Time Employed		
							Education Level		
							Forty-five Years and Over	Less than Grade Nine	Post Secondary
		dollars		dollars	percent		percent		
Atlantic Maritime	13 880	15 400	10 640	18 100	77	16	30	27	31
Prince Edward Island	160	11 500	100	12 900	63	27	...	5	50
Nova Scotia	6 785	15 700	5 660	17 400	83	14	34	25	31
New Brunswick	4 235	15 000	3 045	18 600	72	18	26	31	32
Québec	2 705	15 600	1 840	19 800	68	18	27	27	25
Mixed-Wood Plain	23 905	17 600	18 810	20 800	79	21	35	21	41
Québec	12 255	17 900	9 785	20 800	80	17	37	27	36
Ontario	11 650	17 300	9 025	20 800	77	26	34	14	47
Boreal Shield	57 650	19 400	49 085	21 600	85	22	31	24	28
Newfoundland	3 345	15 600	2 280	18 700	68	18	27	29	35
Québec	15 790	20 000	13 230	22 600	84	21	28	28	28
Ontario	32 825	19 400	28 565	21 300	87	21	34	23	27
Manitoba	5 145	20 100	4 560	21 800	89	31	21	13	37
Saskatchewan	550	16 700	455	19 200	83	22	32	26	33
Prairie	70 390	22 600	59 245	25 300	84	43	19	5	58
Manitoba	1 405	17 300	940	21 800	67	28	28	17	34
Saskatchewan	11 110	20 200	9 225	22 400	83	36	20	11	40
Alberta	57 875	23 200	49 085	25 900	85	44	18	4	61
Boreal Plain	22 445	23 000	18 430	25 900	82	54	15	10	40
Manitoba	635	13 600	415	17 600	65	18	25	33	27
Saskatchewan	995	14 300	545	18 900	55	28	15	26	21
Alberta	19 055	23 700	16 035	26 200	84	57	15	9	41
British Columbia	1 740	23 700	1 415	27 000	81	52	14	12	32
Montane Cordillera	16 540	21 100	14 160	23 200	86	44	24	9	44
Alberta	2 055	21 500	1 800	23 200	88	39	20	11	37
British Columbia	14 490	21 100	12 360	23 100	85	45	25	9	45
Pacific Maritime	7 420	20 700	5 580	24 600	75	48	24	7	54
British Columbia	7 420	20 700	5 580	24 600	75	48	24	7	54
Boreal Cordillera	1 780	23 200	1 425	27 000	80	51	19	9	48
British Columbia	540	21 500	430	25 100	80	56	22	8	52
Yukon	1 245	23 900	990	27 800	80	49	17	10	47
Tundra Cordillera	370	21 600	280	25 300	76	46	32	9	58
Yukon	225	17 500	165	20 900	73	36	39	6	64
Northwest Territories	150	27 700	115	31 400	77	58	30	13	48
Taiga Plain⁴	785	19 600	660	22 000	84	45	17	13	45
Northwest Territories	750	19 400	620	21 900	83	45	18	13	46
Taiga Shield	7 365	23 900	6 520	25 800	89	36	18	10	47
Newfoundland	3 550	25 000	3 245	26 300	91	26	15	5	53
Québec	2 130	25 300	1 885	27 300	88	39	22	16	38
Saskatchewan	750	19 900	625	22 300	83	60	15	12	40
Northwest Territories	930	19 700	760	22 500	82	52	23	12	45
Southern Arctic⁴	350	11 500	135	18 100	39	19	22	41	15
Northwest Territories	315	11 600	110	19 200	35	23	27	36	18
Northern Arctic⁴	255	16 600	170	21 800	67	54	23	29	38
Northwest Territories	210	17 100	130	23 800	62	70	24	31	42

¹ Standard industrial classification division 4: Mines (including milling), Quarries and Oil Wells.² Employed in 1980.³ Employed 27 or more weeks in 1980.⁴ Provinces with minimal industry employment are not listed; however, ecozone totals include the statistics for these provinces.**Source:**
Statistics Canada, 1981 Census of Population, special tabulation.**Note:**
Individual items may not add to totals due to rounding.

5

Environmental Restructuring



Contents

5.1	Land Use and Land Conversion	173
5.2	Restructuring of Water Systems	185
5.3	Transport Networks	197
5.4	Resource Development	207

Tables

5.1.3	Rural to Urban Land Conversion, 1966 to 1976	176
5.1.4	Agricultural Land Converted to Urban Use, 1966 to 1976	177
5.1.5	Land with High Capability for Agriculture, Forestry, Recreation or Waterfowl Converted to Urban Use, 1966 to 1976	179
5.1.7	Population in Major Fruitland Regions	181
5.1.8	Major Fruitlands: Area and Number of Trees, 1961 and 1981	182
5.2.1	Large Dams by Major Drainage Area, 1982	186
5.2.3	Major Dams by Ecozone, 1984	190
5.2.4	Major Reservoirs by Ecozone, 1984	191
5.2.6	Major Water Transfers, 1985	193
5.2.8	Water Withdrawal and Consumption by Sector, 1981	195
5.2.9	Water Withdrawal and Consumption, by Major Drainage Area, 1981	195
5.3.2	Length of Federal and Provincial Roads and Highways, 1982	199
5.3.4	Aerodromes and Heliports, 1980	201
5.3.9	Length of Electric Transmission Circuit by Power Line Voltage, 1956 to 1982	205
5.4.2	Major Resource Projects — Oil and Gas	209
5.4.3	Major Resource Projects — Hydro-Electricity Generation and Distribution	210
5.4.4	Major Resource Projects — Metal Mining	210
5.4.5	Major Resource Projects — Industrial Minerals	211
5.4.6	Land Area Utilized by Mining	212

Maps

5.1.2	General Land Cover	175
5.1.6	Canada's Major Fruitlands	181
5.1.9	Urbanization in the Niagara Fruitbelt, 1934 and 1975	183
5.1.10	Urbanization in the Okanagan Valley, 1966 and 1981	184
5.2.2	Large Dam Construction	188
5.2.5	Major Water Transfers, 1985	192
5.3.3	Evolution of the Northern Road Network	200
5.3.5	Major Oil and Gas Pipelines, 1984	202
5.3.8	Major Electric Transmission Lines	204
5.4.1	Major Resource Projects	208

Charts

5.1.1	General Land Cover	174
5.3.1	Mainline Railroad Track by Region, 1850 to 1981	198
5.3.6	Length of Oil Pipelines, 1950 to 1983	203
5.3.7	Length of Natural Gas Pipelines, 1960 to 1983	203

Technical Box

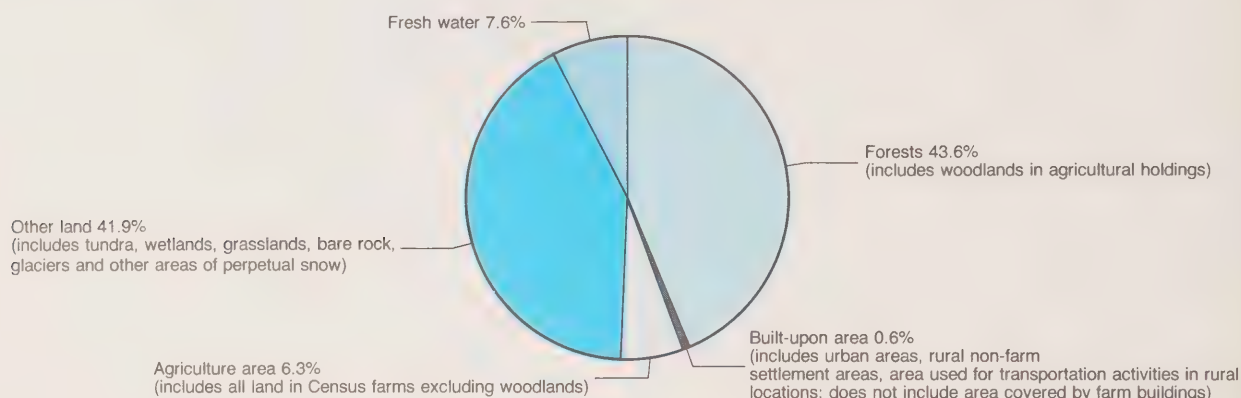
5.2.7	Selected Streamflow Alterations in the Saskatchewan-Nelson Basins	194
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5.1

Land Use and Land Conversion



Chart 5.1.1
General Land Cover¹



¹ The total area of land and freshwater in Canada is 9 970 610 square kilometres.

Sources:

Area of land and freshwater: Energy, Mines and Resources Canada, Surveys and Mapping Branch, Geographical Research Division.

Forest land: Environment Canada, Canadian Forestry Service, *Canada's Forest Inventory, 1981* by G.M. Bonner, Ottawa, 1982. Page 4. The figure presented is the total area of forest land. This includes the inventoried portion of forest land in Canada as well as an estimate made by the Provinces and/or by the Canadian Forestry Service of the additional non-inventoried forest area.

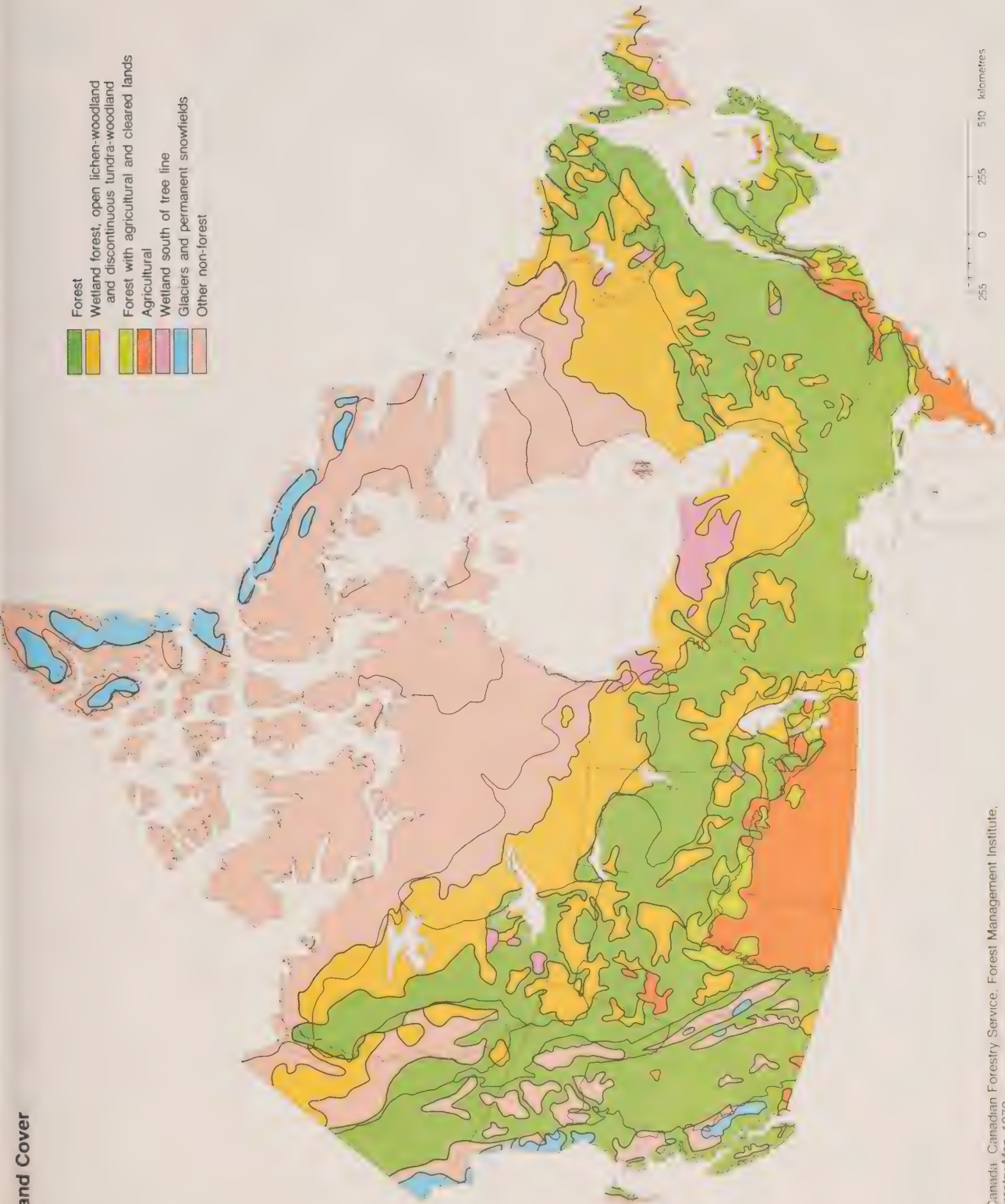
Agricultural land: This is the 1981 Census of Agriculture area of farms figure (improved and unimproved lands) minus the area in woodlots. For further details on definitions see Chapter 3, Section 1.

Built-upon land: There are no comprehensive government statistics on built-upon area. These data are estimates made by John Hansen and are considered to be among the best available at the national level, see J. Hansen, "Built-on Land Definition and Canadian Area Estimates," *Plan Canada*, Volume 23, Number 4, March 1984.

Note:

Land statistics can be generated for land cover types (bio-physical classes) or by the human activities taking place on the land (functional use). Statistics on activities using the land can be used as indicators of stress, whereas land cover change provides an indication of environment response. The land use classification systems in use in most municipalities tend to be a mixture of cover and activity; for example, built-upon area (a cover category) is classified as residential, commercial and industrial (activity categories). Problems arise when several uses are made of the same parcel of land; for example, a forest which serves the forestry industry can also provide recreation space and support animal trapping activity. In contrast, cover classes are mutually exclusive. Environment Canada is currently developing the Canada Land Use Monitoring Program (CLUMP) for the purpose of tracking land change in Canada. CLUMP employs a complementary land cover and land activity classification for land statistics.

Map 5.1.2
General Land Cover



Source: Environment Canada, Canadian Forestry Service, Forest Management Institute, Provisional Forestry Map, 1979.

Table 5.1.3
Rural to Urban Land Conversion, 1966 to 1976

Urban Area ¹ by Ecozone	Built-up Area 1976	Land Converted 1966 to 1971	Land Converted 1971 to 1976	Urban Area Population 1976
hectares				
Atlantic Maritime	38 115	4 398	4 843	652 672
Halifax (N.S.)	11 617	1 424	767	211 983
Saint John (N.B.)	6 491	1 092	1 156	106 561
Sydney (N.S.)	4 437	282	267	76 699
Moncton (N.B.)	4 244	299	1 176	77 571
Fredericton (N.B.)	2 740	412	466	45 248
Sept Îles (Qué.)	2 292	235	269	30 617
Sydney Mines (N.S.)	1 809	104	109	22 296
Baie Comeau (Qué.)	1 692	182	48	26 635
Charlottetown (P.E.I.)	1 677	309	414	24 837
Rimouski (Qué.)	1 116	59	171	30 225
Mixed-Wood Plain	389 307	49 364	29 879	9 744 594
Toronto (Ont.)	91 665	11 689	6 098	2 778 720
Montréal (Qué.)	71 570	7 719	2 627	2 801 262
Ottawa (Ont.)	27 056	3 419	2 010	478 519
St. Catharines-Niagara (Ont.)	19 529	4 388	1 081	295 860
Québec (Qué.)	18 678	2 748	2 370	517 333
Hamilton (Ont.)	18 509	2 046	1 005	499 784
Windsor (Ont.)	13 216	1 225	844	223 922
Kitchener (Ont.)	11 897	2 529	1 368	259 270
London (Ont.)	10 973	1 198	738	247 263
Oshawa (Ont.)	8 310	609	407	135 196
Hull (Qué.)	7 280	1 197	865	182 773
Sarnia (Ont.)	6 171	575	632	71 135
Kingston (Ont.)	5 952	962	432	78 623
Trois Rivières (Qué.)	5 375	136	1 262	96 954
Peterborough (Ont.)	5 114	669	230	63 219
Brantford (Ont.)	5 104	599	393	75 718
Sherbrooke (Qué.)	4 745	365	335	94 691
Shawinigan (Qué.)	3 975	360	285	55 414
Barrie (Ont.)	3 634	306	532	36 326
Fort Erie (Ont.)	3 550	698	202	24 031
Guelph (Ont.)	3 529	491	292	67 538
Woodstock (Ont.)	3 166	336	471	26 779
Drummondville (Qué.)	3 137	169	647	42 073
St. Jean (Qué.)	3 017	551	448	50 363
Valleyfield (Qué.)	2 569	207	353	34 163
St. Thomas (Ont.)	2 447	348	246	28 913
Midland (Ont.)	2 398	279	250	20 625
Joliette (Qué.)	2 304	880	189	26 769
Cornwall (Ont.)	2 299	63	292	46 121
Trenton (Ont.)	2 201	262	285	24 885
Chatham (Ont.)	2 166	206	217	38 685
St. Jerome (Qué.)	2 154	340	273	36 489
Sorel (Qué.)	2 073	300	262	34 761
Belleville (Ont.)	2 052	231	343	35 311
St. Hyacinthe (Qué.)	1 743	68	244	40 202
Stratford (Ont.)	1 731	165	152	25 657
Granby (Qué.)	1 711	114	305	37 896
Victoriaville (Qué.)	1 659	344	307	27 732
Brockville (Ont.)	1 592	177	199	21 233
Halton Hills (Ont.)	1 564	65	199	34 477
Thetford Mines (Qué.)	1 492	331	189	27 909
Boreal Shield	46 900	4 224	3 577	794 966
Sudbury (Ont.)	10 126	1 207	510	156 840
Thunder Bay (Ont.)	7 222	574	600	111 476
Chicoutimi-Jonquière (Qué.)	6 811	736	642	140 782
St. John's (Nfld.)	6 385	685	672	129 042
Sault Ste. Marie (Ont.)	5 534	464	330	81 049
North Bay (Ont.)	4 060	254	292	52 707
Corner Brook (Nfld.)	1 900	22	92	25 198
Alma (Qué.)	1 792	151	118	25 638
Timmins (Ont.)	1 790	77	266	44 747
Rouyn (Qué.)	1 280	54	55	27 487
Prairie	106 143	21 146	15 626	2 025 590
Edmonton (Alta.)	29 407	6 552	5 808	527 918
Calgary (Alta.)	25 133	6 417	4 964	469 917
Winnipeg (Man.)	23 894	4 385	1 300	560 874
Regina (Sask.)	7 623	380	1 164	149 593
Saskatoon (Sask.)	6 709	474	442	133 750
Medicine Hat (Alta.)	3 231	606	471	35 820
Lethbridge (Alta.)	2 927	422	687	46 752
Brandon (Man.)	2 850	814	141	34 901
Red Deer (Alta.)	2 360	701	349	32 184
Moose Jaw (Sask.)	2 009	395	300	33 881

Table 5.1.3
Rural to Urban Land Conversion, 1966 to 1976 (concluded)

Urban Area ¹ by Ecozone	Built-up Area 1976	Land Converted 1966 to 1971	Land Converted 1971 to 1976	Urban Area Population 1976
hectares				
Boreal Plain	2 234	238	504	28 631
Prince Albert (Sask.)	2 234	238	504	28 631
Montane Cordillera	11 810	2 662	2 574	170 195
Prince George (B.C.)	5 197	1 187	1 027	59 929
Kamloops (B.C.)	3 379	856	398	58 311
Kelowna (B.C.)	3 234	619	1 149	51 955
Pacific Maritime	65 531	5 064	5 295	1 385 377
Vancouver (B.C.)	47 499	3 661	3 471	1 106 985
Victoria (B.C.)	10 944	474	1 020	195 135
Nanaimo (B.C.)	3 626	442	325	40 336
Chilliwack (B.C.)	1 857	275	275	21 746
Port Alberni (B.C.)	1 605	212	204	21 175
National Total	660 040	87 096	62 298	14 802 025

¹ All urban areas with a population of greater than 25,000 in 1976 were inventoried by Environment Canada. Many of these urban areas are Census Metropolitan Areas or Census Agglomerations. It should be noted, however, that the area encompassed by this study is often smaller than the total area of the C.M.A. or C.A. The study focussed on the conversion of land in the rural-urban fringe of these centres and excluded municipalities outside this zone. It should also be noted that many of the urban areas here are components of C.M.A.s or C.A.s which have been split. For example, the Ottawa-Hull C.M.A. is divided into its Ottawa and Hull components. Also, urban areas which spread over two or more ecozones are assigned to the ecozone in which they are predominantly located.

Sources:

Environment Canada, Lands Directorate, *The Urbanization of Rural Land in Canada: 1966-1971 and 1971-1976*, by C.L. Warren and P.C. Rump, Catalogue En. 73-1/20, 1981.
Environment Canada, Lands Directorate, *Rural to Urban Land Conversion*, by D.M. Gierman, Catalogue En. 66-1/16, 1977.

Table 5.1.4
Agricultural Land¹ Converted to Urban Use, 1966 to 1976

Urban Area ² by Ecozone	Improved Agricultural Land Converted	Unimproved Pasture Converted	Total Converted
hectares			
Atlantic Maritime	1 870	1 040	2 910
Halifax (N.S.)	82	23	105
Saint John (N.B.)	383	362	745
Sydney (N.S.)	27	128	155
Moncton (N.B.)	236	228	464
Fredericton (N.B.)	357	88	445
Sept Îles (Qué.)	...	16	16
Sydney Mines (N.S.)	74	42	116
Baie Comeau (Qué.)	6	21	27
Charlottetown (P.E.I.)	558	94	652
Rimouski (Qué.)	147	38	185
Mixed-Wood Plain	47 337	15 934	63 271
Toronto (Ont.)	14 609	1 688	16 297
Montréal (Qué.)	4 233	3 221	7 454
Ottawa (Ont.)	3 158	1 337	4 495
St.Catharines-Niagara (Ont.)	2 839	2 026	4 865
Québec (Qué.)	1 771	1 274	3 045
Hamilton (Ont.)	2 146	548	2 694
Windsor (Ont.)	1 859	134	1 993
Kitchener (Ont.)	2 608	743	3 351
London (Ont.)	1 196	539	1 735
Oshawa (Ont.)	723	187	910
Hull (Qué.)	838	357	1 195
Sarnia (Ont.)	834	132	966
Kingston (Ont.)	912	326	1 238
Trois-Rivières (Qué.)	532	214	746
Peterborough (Ont.)	597	154	751
Brantford (Ont.)	581	304	885
Sherbrooke (Qué.)	159	190	349
Shawinigan (Qué.)	137	210	347
Barrie (Ont.)	501	116	617
Fort Erie (Ont.)	295	464	759

Table 5.1.4
Agricultural Land¹ Converted to Urban Use, 1966 to 1976 (concluded)

Urban Area ² by Ecozone	Improved Agricultural Land Converted	Unimproved Pasture Converted	Total Converted
hectares			
Guelph (Ont.)	607	85	692
Woodstock (Ont.)	640	111	751
Drummondville (Qué.)	338	196	534
St-Jean (Qué.)	585	80	665
Valleyfield (Qué.)	391	94	485
St. Thomas (Ont.)	458	87	545
Midland (Ont.)	91	53	144
Joliette (Qué.)	429	142	571
Cornwall (Ont.)	176	56	232
Trenton (Ont.)	215	226	441
Chatham (Ont.)	412	3	415
St-Jérôme (Qué.)	127	158	285
Sorel (Qué.)	223	45	268
Belleville (Ont.)	405	70	475
St-Hyacinthe (Qué.)	253	26	279
Stratford (Ont.)	292	4	296
Granby (Qué.)	201	69	270
Victoriaville (Qué.)	376	123	499
Brockville (Ont.)	280	49	329
Halton Hills (Ont.)	167	29	196
Thetford Mines (Qué.)	143	64	207
Boreal Shield	1 943	1 050	2 993
Sudbury (Ont.)	166	207	373
Thunder Bay (Ont.)	148	241	389
Chicoutimi-Jonquière (Qué.)	736	187	923
St. John's (Nfld.)	334	86	420
Sault Ste. Marie (Ont.)	203	139	342
North Bay (Ont.)	66	65	131
Corner Brook (Nfld.)	7	...	7
Alma (Qué.)	121	29	150
Timmins (Ont.)	138	71	209
Rouyn (Qué.)	24	25	49
Prairie	26 955	7 302	34 257
Edmonton (Alta.)	10 191	1 496	11 687
Calgary (Alta.)	7 691	3 144	10 835
Winnipeg (Man.)	3 842	932	4 774
Regina (Sask.)	1 501	43	1 544
Saskatoon (Sask.)	803	105	908
Medicine Hat (Alta.)	366	682	1 048
Lethbridge (Alta.)	750	147	897
Brandon (Man.)	481	384	865
Red Deer (Alta.)	814	193	1 007
Moose Jaw (Sask.)	516	176	692
Boreal Plain	327	132	459
Prince Albert (Sask.)	327	132	459
Montane Cordillera	1 167	1 656	2 823
Prince George (B.C.)	145	155	300
Kamloops (B.C.)	209	811	1 020
Kelowna (B.C.)	813	690	1 503
Pacific Maritime	3 471	2 551	6 022
Vancouver (B.C.)	2 604	1 470	4 074
Victoria (B.C.)	378	577	955
Nanaimo (B.C.)	35	247	282
Chilliwack (B.C.)	434	77	511
Port Alberni (B.C.)	20	180	200
National Total	83 070	29 665	112 735

¹ See Footnote 1, Table 5.1.3

² Agricultural land, improved agricultural land and unimproved pasture are defined here according to the Canada Land Inventory present use classification. Improved agricultural land includes improved pasture, crop lands, areas in forage crops, orchards and vineyards, and horticulture lands. Unimproved pasture includes grassland, natural range land, abandoned farmland and lightly wooded areas. The data here were derived by comparing the 1966 Canada Land Inventory present uses with airphotos of the same areas for 1971 and 1976.

Source:

Environment Canada, Lands Directorate, *The Urbanization of Rural Land in Canada: 1961-1971 and 1971-1976*, by C.L. Warren and P.C. Rump, Catalogue En. 73-1/20, 1981.

Table 5.1.5
Land with High Capability¹ for Agriculture, Forestry, Recreation or Waterfowl Converted to Urban Use, 1966 to 1976

Urban Area by Ecozone	Agriculture	Forestry	Recreation	Waterfowl
	hectares			
Atlantic Maritime	3 177	266	460	192
Halifax (N.S.)	636	...	126	5
Saint John (N.B.)	49	0	62	17
Sydney (N.S.)	427	...	...	...
Moncton (N.B.)	903	62	...	164
Fredericton (N.B.)	208	23	...	6
Sept Îles (Qué.)	...	...	146	...
Sydney Mines (N.S.)	182	...	...	...
Baie Comeau (Qué.)	14	...	70	...
Charlottetown (P.E.I.)	721	...	50	...
Rimouski (Qué.)	37	181	6	...
Mixed-Wood Plain	58 071	58 867	1 304	408
Toronto (Ont.)	17 057	12 899	42	30
Montréal (Qué.)	7 669	8 370	213	80
Ottawa (Ont.)	3 182	3 013	40	17
St. Catharines-Niagara (Ont.)	4 450	3 685	185	56
Québec (Qué.)	1 971	3 090	53	...
Hamilton (Ont.)	2 640	2 023	39	5
Windsor (Ont.)	1 891	2 007	50	4
Kitchener (Ont.)	2 578	3 562	5	51
London (Ont.)	1 936	1 902	6	4
Oshawa (Ont.)	907	977	1	22
Hull (Qué.)	1 187	1 209	13	9
Sarnia (Ont.)	1 081	1 144	59	...
Kingston (Ont.)	847	470	3	27
Trois Rivières (Qué.)	388	969	...	...
Peterborough (Ont.)	598	779	...	...
Brantford (Ont.)	861	990	...	62
Sherbrooke (Qué.)	145	532	37	...
Shawinigan (Qué.)	...	541	46	...
Barrie (Ont.)	652	733	14	...
Fort Erie (Ont.)	900	621	...	...
Guelph (Ont.)	684	777	22	...
Woodstock (Ont.)	773	759	12	...
Drummondville (Qué.)	286	362	...	...
St. Jean (Qué.)	967	903	300	12
Valleyfield (Qué.)	472	363	...	6
St. Thomas (Ont.)	566	542	15	...
Midland (Ont.)	182	369	10	...
Joliette (Qué.)	251	1 017	...	...
Cornwall (Ont.)	264	352	13	...
Trenton (Ont.)	336	402	...	4
Chatham (Ont.)	411	423	...	...
St. Jerome (Qué.)	243	525	13	...
Sorel (Qué.)	55	562	47	14
Belleville (Ont.)	459	357	2	2
St. Hyacinthe (Qué.)	238	244	...	...
Stratford (Ont.)	275	316	...	...
Granby (Qué.)	101	192	...	3
Victoriaville (Qué.)	230	475	...	...
Brockville (Ont.)	91	38	13	...
Halton Hills (Ont.)	209	206	...	...
Thetford Mines (Qué.)	38	167	18	...
Boreal Shield	1 656	1 740	419	46
Sudbury (Ont.)	256	592	22	31
Thunder Bay (Ont.)	102	38	86	5
Chicoutimi-Jonquière (Qué.)	712	852	56	5
St. John's (Nfld.)	4	9	...	...
Sault Ste. Marie (Ont.)	298	61	45	2
North Bay (Ont.)	58	74	175	...
Corner Brook (Nfld.)	...	5	24	...
Alma (Qué.)	83	109	7	...
Timmins (Ont.)	134	...	...	1
Rouyn (Qué.)	9	...	4	2
Prairie	26 622	35	7	5 731
Edmonton (Alta.)	10 281	...	7	4 958
Calgary (Alta.)	6 154	...	...	651
Winnipeg (Man.)	5 680	35	...	...
Regina (Sask.)	1 507	...	...	38
Saskatoon (Sask.)	540	...	...	25
Medicine Hat (Alta.)	10	...	...	6
Lethbridge (Alta.)	427	...	...	...
Brandon (Man.)	409	...	...	19
Red Deer (Alta.)	975	...	...	...

Table 5.1.5

Land with High Capability¹ for Agriculture, Forestry, Recreation or Waterfowl Converted to Urban Use, 1966 to 1976 (concluded)

Urban Area by Ecozone	Agriculture	Forestry	Recreation	Waterfowl
	hectares			
Moose Jaw (Sask.)	639	...	...	34
Boreal Plain	355	...	...	311
Prince Albert (Sask.)	355	...	...	311
Montane Cordillera	1 734	66	376	89
Prince George (B.C.)	319	25	...	...
Kamloops (B.C.)	..	..	184	73
Kelowna (B.C.)	1 415	41	192	16
Pacific Maritime	1 385	45	453	3 930
Vancouver (B.C.)	738	..	226	2 827
Victoria (B.C.)	..	..	146	216
Nanaimo (B.C.)	25	7	44	450
Chilliwack (B.C.)	347	38	37	301
Port Alberni (B.C.)	275	..	...	136
National Total	93 000	61 019	3 019	10 707

¹ Land capability is based on the Canada Land Inventory capability assessment. It should be noted that high capability land in each of the groups includes land which is actually in that use as well as land which is not currently in the use but which could be, with no significant limitations for that use.

Source:

Environment Canada, Lands Directorate *The Urbanization of Rural Land in Canada: 1966-1971 and 1971-1976*, by C.L. Warren and P.C. Rump, Catalogue En. 73-1/20, 1981.

Note:**The Canada Land Inventory**

The Canada Land Inventory program involved the mapping and assessment of 2.5 million square kilometres of land in the settled areas of Canada, for agriculture, forestry, recreation, and wildlife capability as well as present land use. The information for the C.L.I. mapping was gathered between 1960 and 1968, and compiled usually at a scale of 1:50,000. The interpretation of land use was completed by field survey and air photo review.

Land capability refers to the ability of the land to accommodate a particular use or activity without permanent damage. Determination of capability involves interpreting climatic, vegetation, soil, and other data in terms of limitations for use and recognizing the role of technology and money in overcoming limitations. Seven classes of capability were established for each use.

Classes 1 to 3 are considered high capability land for each category of rural land.

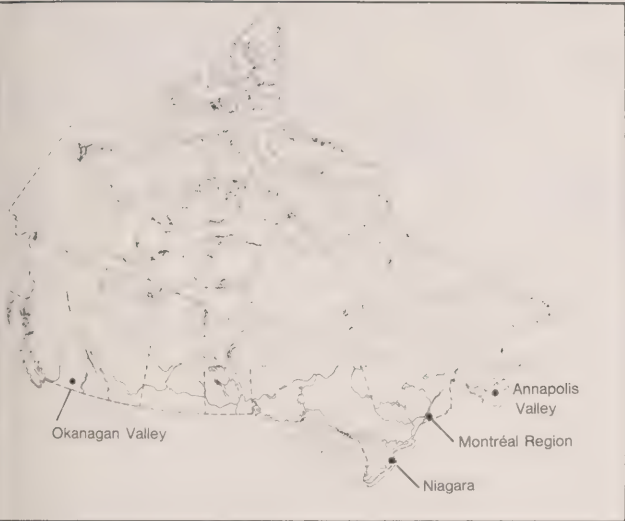
High Capability Agricultural Lands: These are soils having no significant limitations in use for crops, to soils having moderately severe limitations that restrict the range of crops or require special conservation requirements (for detail refer to Technical Box 3.1.2).

High Capability Forestry Lands: These range from lands having no important limitations, to moderate limitations that restrict the growth of commercial forests (several regions in Canada have no class 1 forestry land because they lack suitable climate).

High Capability Recreation Lands: These have very high to moderately high capability for outdoor recreation.

High Capability Wildlife-Waterfowl Lands: These lands have no significant limitations to slight limitations for the production of waterfowl. Ratings are established on the basis of the optimum vegetational stage that can be maintained when good wildlife management is practiced. Ratings assigned do not reflect present land use (except in extreme cases, such as heavily populated areas), ownership, lack of access, distance from cities, or amount of hunting pressure.

Map 5.1.6
Canada's Major Fruitlands



There are only a few areas in Canada with the combination of soils and climate suitable for the growth of fruit trees and grapes on a commercial scale. The four major ones are the Okanagan Valley, the Niagara Peninsula, the Annapolis Valley and the Montréal region. Canada's tender fruit and grape growing industries are highly concentrated in the Niagara and Okanagan (seventy-six percent of all Canada's area of tender fruit trees and ninety-six percent of total grapevine area), while apples are the main products of the Annapolis Valley and the Montréal fruitlands.

The concentration of orchards and vineyards in small areas that have distinct topographical and climatic features has made them susceptible to external pressures for land use change.

The Okanagan and Niagara fruitlands are particularly under pressure from nearby expanding urban areas and developing industries. The mild climate of the areas has contributed to the attraction of Niagara and the Okanagan as retirement centres which has further stimulated urban growth. The flat fertile terrain of the Annapolis Valley combined with changing markets has fostered pressures for fruitland conversion to other uses in that region.

The Montréal fruitlands have been under less conversion pressure in the past but as the region's rural-urban fringe reaches these areas, land use transformation may accelerate.

Table 5.1.7
Population in Major Fruitland Regions

	Population ¹				Population Change 1961 to 1981	Major Fruits Grown
	1921	1941	1961	1981		
					percent	
Annapolis ² (Nova Scotia)	42 757	48 583	67 084	74 718	11.4	apples
Montréal Area ³ (Québec)	11 318	12 736	20 152	30 581	51.8	apples
Niagara ⁴ (Ontario)	82 083	109 143	223 689	300 435	34.3	apples, cherries, grapes, peaches, pears, plums
Okanagan ⁵ (British Columbia)	..	36 366	74 833	171 323	128.9	apples, apricots, cherries, grapes, peaches, plums

¹ The populations of the fruitlands are actually the populations for Census Sub-Divisions containing, or immediately adjacent to, fruitland areas. The Annapolis and Okanagan fruitlands are situated in long valleys and compete with a variety of other activities, both urban and rural, for land. The Niagara fruitland is also a linear development situated primarily on the eastern side of the Niagara escarpment where tender fruits benefit from both a sheltered climate and favorable soils. In contrast, the fruitlands around Montréal are scattered over a large area concentrating at several points on hillsides with southern exposures. Historically, demands for residential land have been less at these sites in comparison with the linear fruitlands. There are indications, however, that this may be changing as Montréal's commuting fringe of urban population begins to reach into these areas and stimulates residential construction.

² Includes the following Census Sub-Divisions (1981 and historical): Annapolis Sub-Divisions A, B and C, Annapolis Royal, Bridgetown, Middleton, Hantsport, Windsor, Kings Sub-Division A, B, C and D, Berwick, Kentville and Wolfville.

³ Includes the following Census Sub-Divisions (1981 and historical): Oka, Oka-sur-le-lac, L'Annonciation N., Hemmingford Sub-Division, Hemmingford, Havelock, Frelighsburg Sub-Division, Frelighsburg, Mont St. Hilaire Sub-Division, St. Michel-de-Rougemont, Otterburn Park, St. Hilaire-sur-Richelieu, Rougemont, Mont-St.-Hilaire, St. Paul d'Abbotsford, St. Cesaire Sub-Division and St. Cesaire.

⁴ Includes the following Census Sub-Divisions (1981 and historical): Stoney Creek, Saltfleet, Grimsby, Lincoln, Pelham, St. Catharines, Niagara-on-the-Lake, Thorold, Niagara Falls, Clinton, Grimsby North, Lincoln West, Louth, Niagara, Stamford, Willoughby, Merriton, Port Dalhousie, Chippawa and Fonthill.

⁵ Includes the following Census Sub-Divisions (1981 and historical): Glenmore, Guisachan, Peachland, Central Okanagan Sub-Divisions A and B, Kelowna, Coldstream, North Okanagan Sub-Division B, Vernon, Penticton, Summerland, Okanagan-Similkameen Sub-Divisions A and B, Keremos, Oliver and Osoyoos.

Sources:
Statistics Canada, 1971 Census of Population, *Population: Census Sub-Divisions (historical)*.
Statistics Canada, 1981 Census of Population, *Population: Geographic Distributions* (for Nova Scotia, Québec, Ontario and British Columbia), Catalogues 93-903, 93-905, 93-906 and 93-910
Environment Canada, Lands Directorate

Table 5.1.8

Major Fruitlands: Area and Number of Trees¹, 1961 and 1981

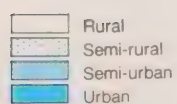
	Annapolis ²		Montréal Area ³		Niagara ⁴		Okanagan ⁵		Canada Total		Major Fruitlands Total as Percent of Canada Total	
	1961	1981	1961	1981	1961	1981	1961	1981	1961	1981	1961	1981
Area:	hectares										percent	
Apple Trees	..	4 328	..	6 444	..	1 370	..	7 183	..	34 112	..	56.7
Other Tender Fruit Trees ⁶	..	372	..	32	..	6 242	..	3 244	..	12 414	..	79.7
All Fruit Trees	5 165	4 700	6 496	6 476	11 630	7 612	13 203	10 427	59 958	46 526	60.9	62.8
Grapes	1	6	1	5	8 820	8 853	250	1 191	9 235	10 386	98.2	96.8
Number of Trees:	number of trees										percent	
Apples	572 104	880 273	782 725	1 247 002	153 747	439 135	1 298 413	2 834 691	4 796 955	8 811 456	58.5	61.3
Other Tender Fruits ⁶	67 744	79 935	4 114	5 408	2 426 750	1 814 007	1 148 671	1 007 422	4 552 778	3 414 251	80.1	85.1

¹ Data are for Census Divisions which contain the major fruitland areas.² Includes the following Census Divisions: Annapolis, Hants and Kings.³ Includes the following Census Divisions: Deux-Montagnes, Huntington, Missisquoi and Rouville.⁴ Includes the following Census Divisions: Niagara Region (formerly Lincoln and Welland), Hamilton-Wentworth Region (formerly Wentworth).⁵ Includes the following Census Divisions for 1981: Central Okanagan, North Okanagan, Okanagan-Similkameen. The 1961 figures are for Census Division 3 which includes an area not covered in the 1981 figures (Kootenay Boundary, Sub-Division B). However, little fruit is grown in this area due to its geographic characteristics.⁶ Tender fruit includes peaches, pears, apricots, cherries and plums.**Sources:**Statistics Canada, 1981 Census of Agriculture, *Horticultural Crops*, Catalogue 96-913, 1982.Statistics Canada, 1961 Census of Agriculture, *Agriculture for Nova Scotia, Québec, Ontario, British Columbia and Canada*, Catalogues 96-530, 96-533, 96-535, 96-536 and 96-540.

Map 5.1.9
Urbanization in the Niagara Fruitbelt, 1934 and 1975

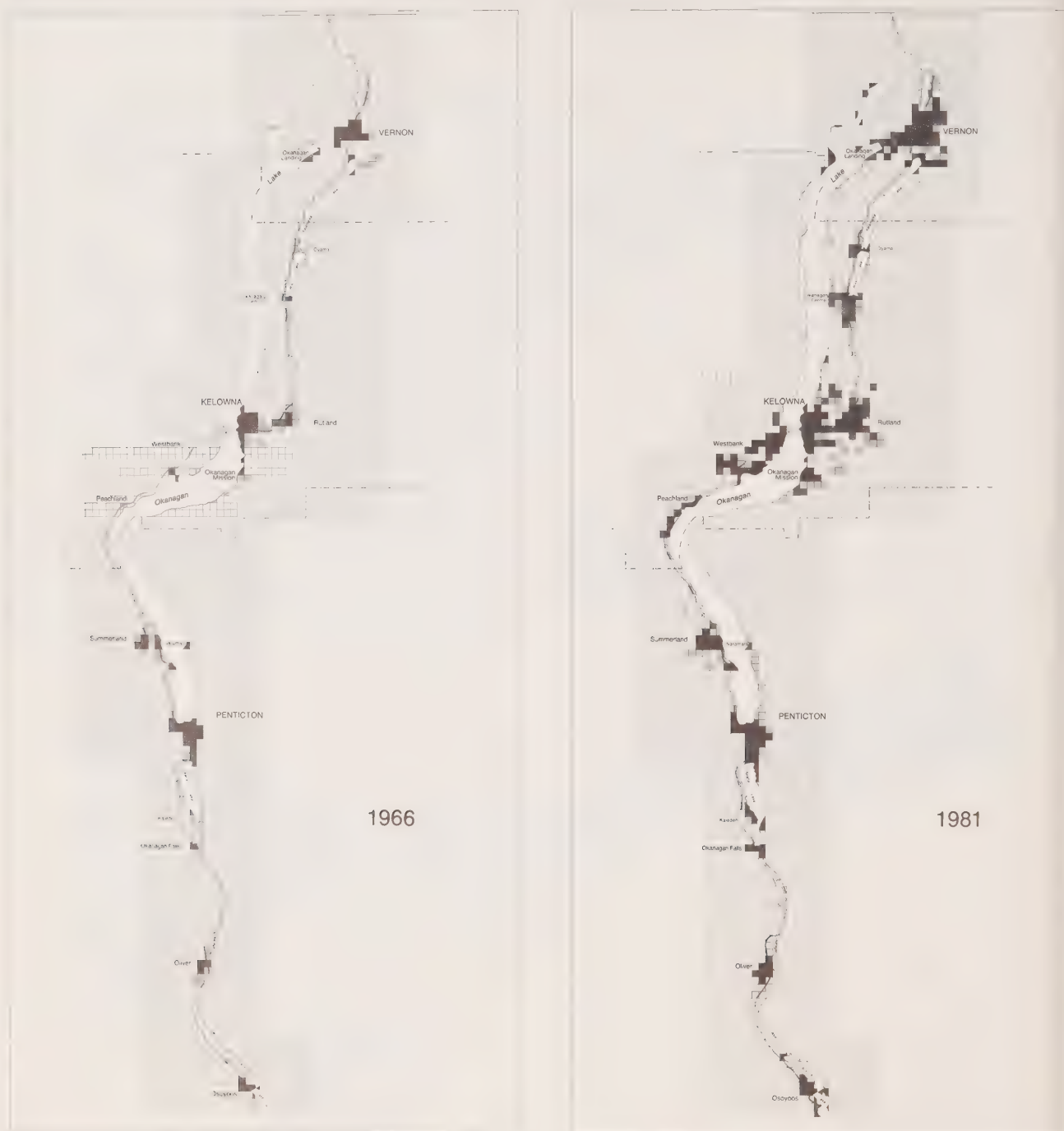


Source:
R. Krueger, "Urbanization of the Niagara Fruitbelt," *The Canadian Geographer*, Volume 22, Number 3, 1978.



4.6 0 4.6 9.2 kilometres

Map 5.1.10

Urbanization in the Okanagan Valley, 1966 and 1981**Source:**

R.R. Krueger and N.G. Maguire, "Changing Urban and Fruit Growing Patterns in the Okanagan Valley, B.C.," *Environments*, Volume 16, Number 1, 1984.

Based upon the ratio of farm to non-farm population.

- Rural
- Semi-rural
- Semi-urban
- Urban

8.7 0 8.7 17.4 kilometres

5.2

Restructuring of Water Systems



Table 5.2.1
Large Dams¹ by Major Drainage Area, 1982

Major Drainage Area	Primary Purpose of Dam ²				Total
	Irrigation	Hydro Power	Water Supply	Water Control, Navigation, Recreation	
Atlantic Ocean Basin	1	236	8	17	262
Atlantic Ocean Coastal	0	54 ³	0	0	54 ³
Newfoundland	0	45 ³	0	0	45 ³
Nova Scotia	0	9	0	0	9
Gulf of St. Lawrence Coastal	0	47 ⁴	4	1	52 ⁴
Newfoundland	0	11	0	0	11
Prince Edward Island	0	0	0	0	0
Nova Scotia	0	7	2	0	9
New Brunswick	0	0	2	0	2
Québec	0	29 ⁴	0	1	30 ⁴
Bay of Fundy Coastal-Saint John River	1	23	1	3	28
Nova Scotia	1	13	0	1	15
New Brunswick	0	10	1	2	13
Québec	0	0	0	0	0
St. Lawrence River	0	46 ⁵	1	4	51 ⁵
Québec	0	44 ⁵	1	3	48 ⁵
Ontario	0	2	0	1	3 ⁵
Ottawa River	0	39	0	0	39
Québec	0	24	0	0	24
Ontario	0	15	0	0	15
Lake Ontario Shore	0	4	0	3	7
Lake Erie and Lake St. Clair Shore	0	0	1	5	6
Lake Huron Shore	0	11	1	1	13
Lake Superior Shore	0	12	0	0	12
Hudson Bay and Ungava Bay Basin	41	144	14	13	212
Hudson Bay and Ungava Bay Coastal	0	99	0	0	99
Québec	0	81 ⁶	0	0	81 ⁶
Ontario	0	12	0	0	12
Manitoba	0	4	0	0	4
Saskatchewan	0	2	0	0	2
Alberta	0	0	0	0	0
Northwest Territories	0	0	0	0	0
Nelson River	0	14 ⁷	0	0	14 ⁷
Lake Winnipeg Shore	0	11	3	6	20
Ontario	0	5	0	4	9
Manitoba	0	6	3	2	11
Saskatchewan	0	0	0	0	0
Assiniboine River	11	0	6	3	20
Manitoba	1	0	1	2	4
Saskatchewan	10	0	5	1	16
Saskatchewan River	30	20	5	4	59
Manitoba	0	1	0	0	1
Saskatchewan	9	1	2	1	13
Alberta	21	18	3	3	45
Arctic Ocean Basin	0	7	0	0	7
Mackenzie River	0	7	0	0	7
Saskatchewan	0	1	0	0	1
Alberta	0	1	0	0	1
British Columbia	0	2	0	0	2
Yukon	0	0	0	0	0
Northwest Territories	0	3	0	0	3
Arctic Ocean Coastal	0	0	0	0	0
Pacific Ocean Basin	13	53	23	1	90
Columbia River	12	17	3	0	32
Fraser River	1	11	2	0	14
Yukon River	0	2	0	0	2
British Columbia	0	0	0	0	0
Yukon	0	2	0	0	2
Pacific Ocean, North Coastal	0	4	4	0	8
British Columbia	0	4	4	0	8
Yukon	0	0	0	0	0
Pacific Ocean, South Coastal	0	19	14	1	34
Gulf of Mexico Basin	1	0	0	1	2
Missouri River	1	0	0	1	2
Saskatchewan	1	0	0	1	2
Alberta	0	0	0	0	0
Canada	56	440	45	32	573

Table 5.2.1
Large Dams¹ by Major Drainage Area, 1982 (concluded)

¹ Large dams are defined by the International Commission on Large Dams as any dam higher than 15 metres, as well as any dams between 10 and 15 metres in height, provided one of the following conditions is met: (a) length of crest greater than 500 metres, (b) reservoir capacity greater than 1 million cubic metres, (c) maximum discharge greater than 2,000 cubic metres per second. In addition a dam may be included if it has especially difficult foundation problems or is of unusual design.

² Only the primary purpose of the dam is used here for classification. Some dams, however, may serve several purposes; for example, a hydro dam may also control water levels in a supply reservoir.

³ Thirty-six of these dams are components of the Churchill Falls Power Project.

⁴ Six of these dams are components of the Outardes 4 Power Project; some of the other dams are components of projects with multiple dams.

⁵ Six of these dams are components of the Isle Maligne Power Project.

⁶ These are all component dams and dykes of the James Bay Power Project.

⁷ Seven of these dams are components of the Kettle Rapids Power Project; many of the other dams are components of the Nelson River Power Project.

Source:

Canadian National Committee, International Commission on Large Dams, *Register of Dams in Canada*, 1982.

Map 5.2.2
Large Dam Construction¹





Large dams are defined by the International Commission on Large Dams, as any dam higher than 15 metres, as well as any dams between 10 and 15 metres in height, provided one of the following conditions is met: (a) length of crest > 500 metres, (b) reservoir capacity > 1 million cubic metres, (c) maximum discharge > 2 000 cubic metres per second; in addition a dam may be included if it has specially difficult foundation problems, or it is of unusual design.

Not all minor dams and side dykes are illustrated for major projects with multiple dams and dykes. These include the Churchill Falls Project, the James Bay Project, the Nelson River Project and the Manicouagan Project.

Source:
Canadian National Committee, International Commission on Large Dams,
Register of Dams in Canada, 1982.

- Water supply
- Water control, navigation, recreation
- Irrigation
- Hydro-power

315 0 315 630 kilometres

Table 5.2.3
Major Dams¹ by Ecozone, 1984

Ecozone	Dam	Province	Drainage Basin and Code	Volume of Dam	Length of Crest	Height above Lowest Foundation	Type	Date of First Power	Generating Capacity
				000's cubic metres	metres	metres			megawatts
Boreal Shield	Manicouagan	Québec	Manicouagan(110.2)	9 175	366	108	Earth		
	Outardes 4,#1	Québec	Outardes(110.2)	7 533	649	122	Rockfill	1969	1 183
	Outardes 4,#2	Québec	Outardes(110.2)	4 688	726	108	Rockfill	1969	632
	Manicouagan 5	Québec	Manicouagan(110.2)	2 255	1 314	214	Multi-arch	1970	1 292
	Lower Notch	Ontario	Upper Ottawa(151)	1 817	1 969	132	Earth/Gravity	1938	228
	Abitibi Canyon	Ontario	Moose(210.3)	710	259	106	Rockfill	1933	234
Prairie	Gardiner	Saskatchewan	South Saskatchewan(253)	65 440	5 090	69	Earth	1968	168
Boreal Plain	Big Horn	Alberta	Upper North Saskatchewan(251)	4 330	472	150	Earth	1972	118
Montane Cordillera	Mica	British Columbia	Columbia(400)	32 111	792	242	Earth	1976	1 736
	NorthRevelstoke	British Columbia	Columbia(400)	13 000	1 620	153	Gravity/Earth	1984	1 843
	Kenney	British Columbia	Upper Fraser(410)	3 071	457	104	Rockfill	1954	813
Boreal Cordillera	Bennett	British Columbia	Peace(302)	43 733	2 042	183	Earth	1968	2 416
Taiga Shield	La Grande 2	Québec	La Grande-Eastmain(200.3)	23 192	2 826	168	Rockfill	1979	5 328
	La Grande 4	Québec	La Grande-Eastmain(200.3)	18 800	3 780	125	Earth/Rockfill	1984	2 637
	La Grande 3	Québec	La Grande-Eastmain(200.3)	13 511	2 156	93	Earth	1982	1 920

¹ Dams presented here are the largest in Canada in terms of volume and/or height.

Sources:

Canadian National Committee, International Commission on Large Dams, *Register of Dams in Canada*, 1982.
Statistics Canada, *Electric Power Statistics, Volume III*, Catalogue 57-206, 1983.

Table 5.2.4
Major Reservoirs¹ by Ecozone, 1984

Ecozone	Reservoir	Project(s)	Province	River(s) Dammed or Diverted	Total Surface Area	Area of Land Flooded	Date of First Hydropower	Generating Capacity
					square kilometres			megawatts
Atlantic Maritime	Mactaquac	Mactaquac	New Brunswick	Saint John	84	61	1968	637
Mixed-Wood Plain	Lake St. Lawrence	R.H. Saunders	Ontario	St. Lawrence	137	91	1958	912
Boreal Shield	Meelpaeg	Bay d'Espoir	Newfoundland	Grey	316	111	1967	613
	Long Pond	Bay d'Espoir	Newfoundland	Salmon	186	130	²	²
	Victoria	Bay d'Espoir	Newfoundland	Victoria	140	78	²	²
	Cabonga	Gatineau Projects ³	Québec	Gatineau	518	212	1927	453
	Baskatong	Gatineau Projects ³	Québec	Gatineau	295	155	²	²
	Matawin	Grand Mère	Québec	Matawin	130	117	1930 ⁴	148
	Gouin	Rapide Blanc	Québec	St. Maurice	1 502	961	1934	184
	Kempt	Rapide Blanc	Québec	Manouane	166	..	²	²
	Peribonca	Peribonca Projects ⁵	Québec	Peribonca	105	..	1942	1 117
	Manouane	Peribonca Projects ⁵	Québec	Manouane	190	..	²	²
	Temiscamingue	Otto Holden	Québec/Ontario	Ottawa	316	..	1952	205
	Kipawa	Otto Holden	Québec	Kipawa	274	..	1952	²
	Pipmuacan	Bersimis 1	Québec	Betsiamites	792	378	1956	912
	Manic 2	Manic 2	Québec	Manicouagan	111	..	1965	1 015
	Lac-Ste-Anne	Manic 2	Québec	Toulousteou	251	146	²	²
	Lac-des-Quinze	Rapide-des-iles	Québec	Ottawa	407	..	1966	146
	Dozois	Rapide-des-iles	Québec	Ottawa	319	197	²	²
	Decelles	Rapide-des-iles	Québec	Ottawa	236	..	²	²
	Victoria	Rapide-des-iles	Québec	Ottawa	148	..	²	²
	Outardes 4	Outardes 4	Québec	Outardes	653	601	1969	632
	Manicouagan	Manic 5	Québec	Manicouagan	1 950	1 574	1970	1 292
	Kelsey	Kelsey	Manitoba	Nelson	706	124	1960	236
	Stevens Lake	Kettle Rapids	Manitoba	Nelson	337	236	1970	1 224
	Southern Indian Lake	Nelson River - Missi Falls	Manitoba	Churchill	2 391	414	1975 ⁴	980 ⁶
	Notigi	Nelson River - Notigi Central	Manitoba	Rat, Churchill	584	431	1975 ⁴	²
	West Nelson Channel	Jenpeg	Manitoba	Nelson	..	76	1976	186
Prairie	Lake Diefenbaker	Coteau Creek	Saskatchewan	South Saskatchewan	430	186	1968	168
Boreal Plain	Cedar Lake	Grand Rapids	Manitoba	Saskatchewan	3 493	1 372	1965	437
	Tobin Lake	Squaw Rapids	Saskatchewan	Saskatchewan	300	246	1963	280
	Bighorn	Bighorn	Alberta	North Saskatchewan	62	60	1972	118
Montane Cordillera	Ootsa Lake	Kemano	British Columbia	Nechako	..	453	1954	813
	Arrow Lakes	Arrow	British Columbia	Columbia	..	103	1968 ⁴	^{2 7}
	McNaughton Lake	Mica Creek	British Columbia	Columbia	445	425	1976	1 736
	Lake Koocanusa	Libby	British Columbia	Kootenay	73	60	1976	⁷
Boreal Cordillera	Williston Lake	G.M. Shrum	British Columbia	Peace	..	1 683	1968	2 416
Taiga Shield	Ossokmanuan	Twin Falls	Newfoundland	Unknown River	950	238	1962	234
	Smallwood	Churchill Falls	Newfoundland	Churchill, Naskaupi, Kanairiktok	5 696	2 848	1971	5 225
	LG2	LG2	Québec	La Grande	2 836	..	1979	5 328
	Opinaca	LG2	Québec	Opinaca, Eastmain	1 036	738	²	²
	LG3	LG3	Québec	La Grande	1 865	..	1982	1 920
	LG4	LG4	Québec	La Grande	..	..	1984	2 637
	Caniapiscau	LG4	Québec	Caniapiscau	4 299	..	²	²

¹ Major reservoirs are defined here as those in which more than 60 square kilometres of land was flooded. In some cases information is not available on area flooded, however information from the sources indicated large scale flooding took place.
² Part of a multi-reservoir project; see related listings for the project for power details.
³ Corbeau, Pagan, Chelsea, Rapide Farmers.
⁴ Date of reservoir construction.
⁵ Chute a la Savanne, Chute des Passes, Chute du Diable.

⁶ Long Spruce.
⁷ Powerhouse in U.S.A..
Sources:
I.E. Eford, "Assessment of the Impact of Hydro Dams," *Fisheries Research Board Journal*, Volume 32, 1975.
Environment Canada, Inland Waters Directorate, unpublished information. Société d'énergie de la Baie James, Direction Environnement, *Reseau de surveillance écologique du Complexe La Grande, 1980*, Montréal, 1981.
R.A. Bodaly, R.E. Hecky and R.J.P. Fudge, "Increases in Fish Mercury Levels in Lakes Flooded by the Churchill River Diversion, Northern Manitoba," *Canadian Journal of Fisheries and Aquatic Sciences*, Volume 41, Number 4, 1984.

Map 5.2.5

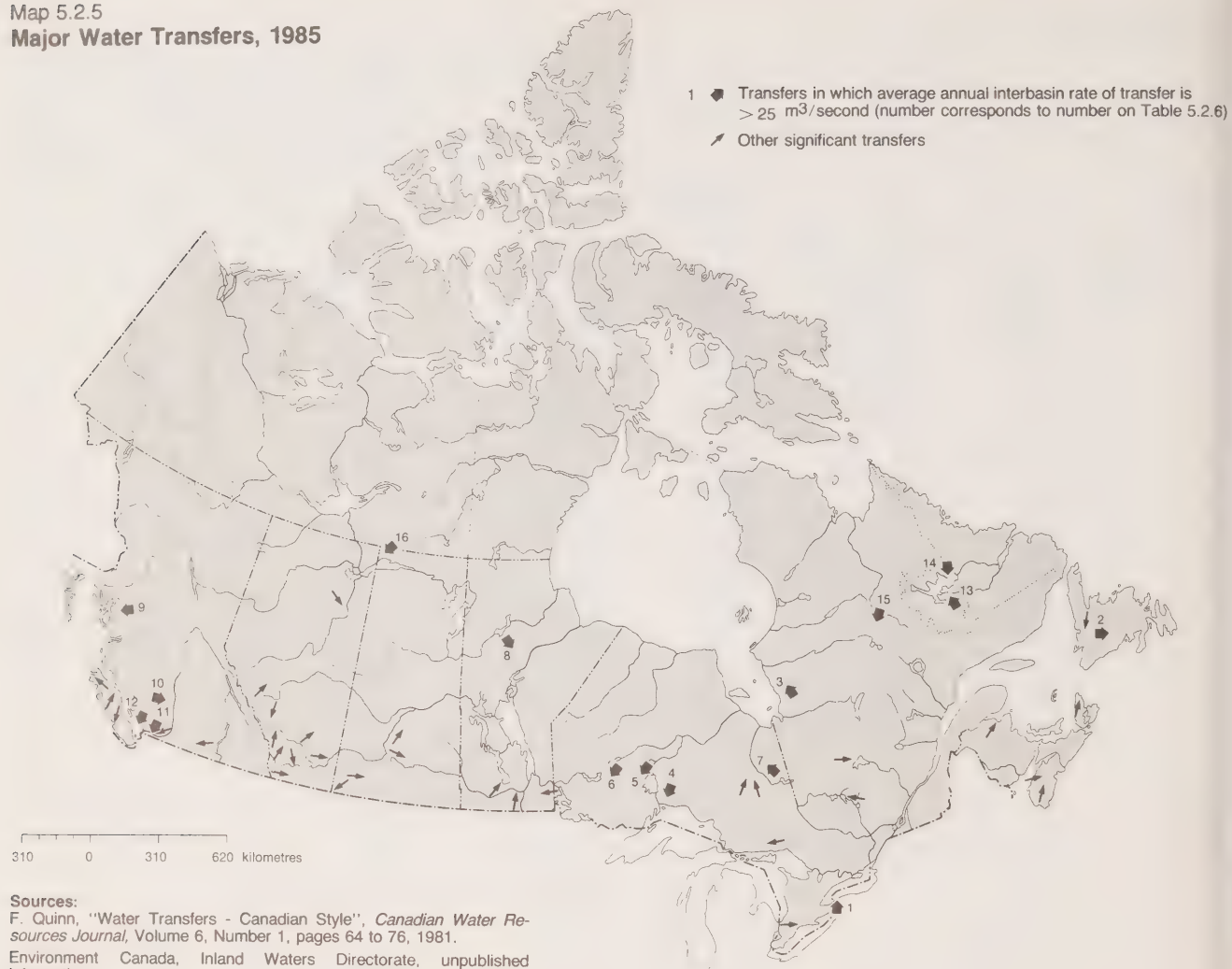
Major Water Transfers, 1985

Table 5.2.6
Major Water Transfers, 1985

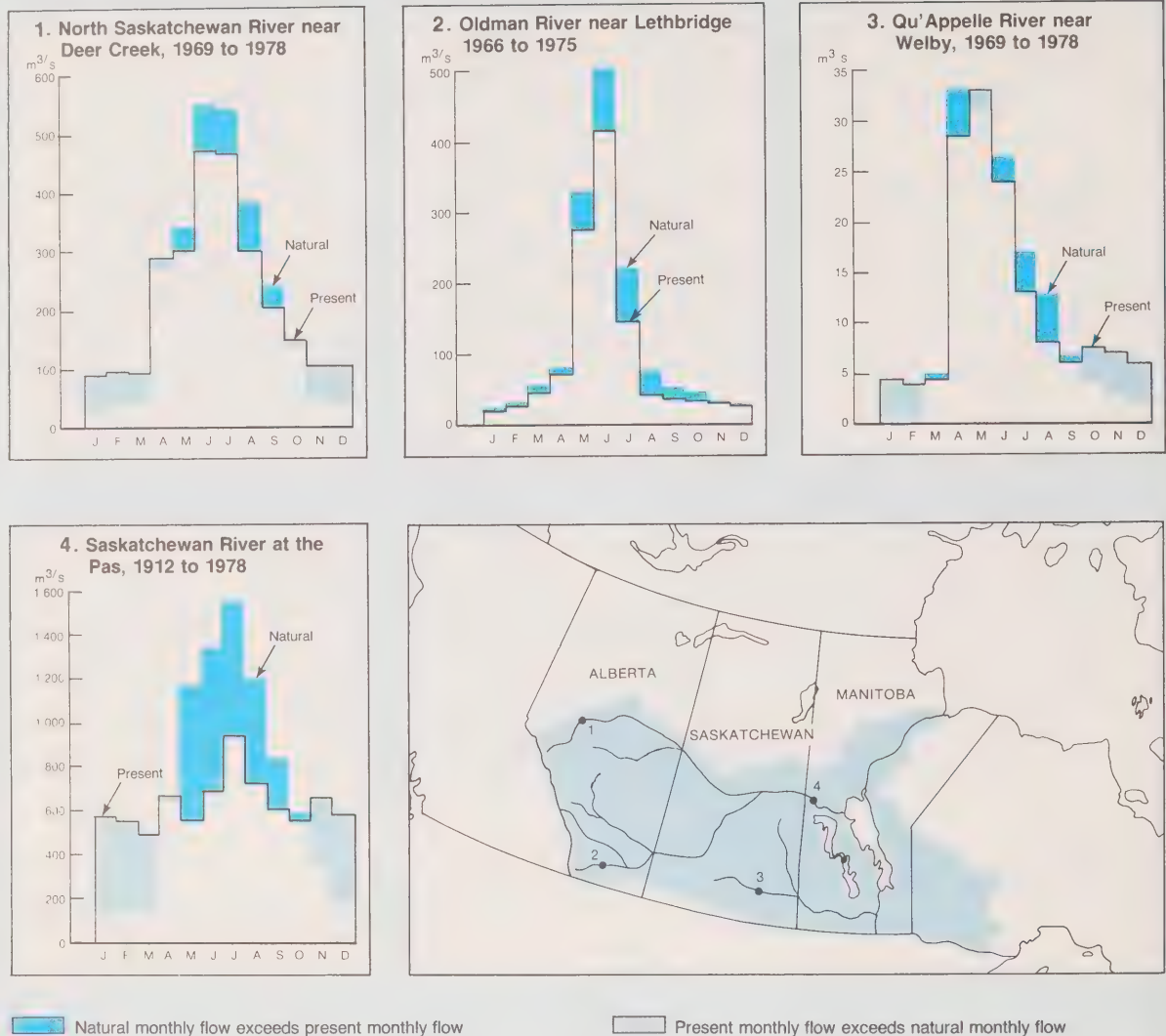
Number on Map	Ecozone(s)	Province	Contributing Waterbody (code)	Receiving Waterbody (code)	Average Annual Transfer Rate cubic metres/ second ¹	Uses	Date Operational
1.	Mixed-Wood Plain	Ontario	Lake Erie(165)	Lake Ontario(165)	250	navigation, hydro	1829
2.	Boreal Shield	Newfoundland	Victoria, Whitebear, Grey and Salmon Rivers(101.111)	Northwest Brook (Bay d'Espoir)(111)	185	hydro	1969
3.	Boreal Shield to Taiga Shield	Québec	Eastmain, Opinaca Rivers(200.3)	La Grande River(200.3)	798	hydro	1980
4.	Boreal Shield to Mixed-Wood Plain	Ontario	Long Lake (Albany River)(210.4)	Lake Superior(190)	38	hydro, logging	1939
5.	Boreal Shield to Mixed-Wood Plain	Ontario	Ogoki River (Albany River)(210.4)	Lake Nipigon(190)	120	hydro	1943
6.	Boreal Shield	Ontario	Lake St. Joseph(Albany River)(210.4)	Root River(230)	86	hydro	1957
7.	Boreal Shield	Ontario	Little Abitibi River(210.3)	Abitibi River(210.3)	40	hydro	1963
8.	Boreal Shield	Manitoba	Churchill River(211.3)	Rat, Burntwood Rivers(220)	752	hydro	1976
9.	Montane Cordillera to Pacific Maritime	British Columbia	Nechako River(410)	Kemano River(431.1)	102	hydro	1952
10.	Montane Cordillera	British Columbia	Bridge River(410)	Seton Lake(410)	92	hydro	1959
11.	Pacific Maritime	British Columbia	Coquitlam Lake(412)	Buntzen Lake(432.1)	28	hydro	1912
12.	Pacific Maritime	British Columbia	Cheakamus River(432.1)	Squamish River(432.1)	37	hydro	1957
13.	Taiga Shield	Newfoundland	Julian, Unknown Rivers(100.2)	Churchill River(100.2)	196	hydro	1971
14.	Taiga Shield	Newfoundland	Naskaupi, Kanairiktok Rivers(100.2)	Churchill River(100.2)	330	hydro	1971
15.	Taiga Shield	Québec	Caniapiscau River(200.2)	La Grande River(200.3)	771	hydro	1983
16.	Taiga Shield	Québec	Lake Frégate(200.3)	La Grande River(200.3)	31	hydro	1982
17.	Taiga Shield	Saskatchewan	Tazin Lake(300.2)	Lake Athabasca(300.2)	25	hydro	1958

¹ Estimates.

Sources:

F. Quinn, "Water Transfers - Canadian Style" *Canadian Water Resources Journal*, Volume 6, Number 1, pages 64 to 76, 1981.
 Environment Canada, Inland Waters Directorate, unpublished information.

Technical Box 5.2.7

Selected Streamflow Alterations in the Saskatchewan-Nelson Basins^{1,2}

¹ It should be noted that the vertical axes (streamflow) are not uniform from one figure to another as the intent is to compare variations in monthly flow patterns rather than to compare actual flow levels from one site to another.

² Natural flows for selected study periods were calculated by removing the effects on flow of man-made diversions, storage and consumptive uses from recorded flow. Present use flows are shown for Figure 4. These were estimated by calculating what streamflow would have been during the same period had the present level of development and use been in existence for that entire period. In the case of Figures 1, 2 and 3, estimates of present use flows were not available and recorded flows for recent years were used to approximate present use flow conditions.

Source:
 Prairie Provinces Water Board, *Water Demand Study, Historical and Current Water Uses in the Saskatchewan-Nelson Basin*, Regina, 1982.

Note:

The above graphs illustrate the effect of environmental restructuring on natural streamflow levels in the Saskatchewan-Nelson Basins. Streamflow is regulated through the use of dams and associated storage reservoirs; the capacity of the latter relative to natural flow rates largely determines stream control. The degree to which these flows are modified depends on

the use made of the water and the natural hydrological cycles of the respective basins. In the case of hydro power generation, municipal supply and flood control, the tendency is to modify the extreme natural flows by reducing the peak levels (April-June) and augmenting the low autumn-winter flows. In agricultural irrigation systems, there is a tendency towards reduced flows throughout the year due to water loss to plants, soil and evaporation. Figure 1, which illustrates stream flow at a point downstream from the Bighorn and Brazeau Reservoirs, is typical of the effect of hydro power generating projects where even flow through the penstocks is required throughout the year. Figure 2 illustrates stream flow modification in an agricultural region of annual water deficits. During the growing season a large volume of water is withdrawn for irrigation. Due to the general scarcity of water, there is a need to contain practically all the water not used in irrigation in the reservoir throughout the year (except during the spring freshet). This leaves little, if any, surplus to augment the stream flow during the low (natural) flow periods. Figure 3 illustrates multipurpose streamflow control for municipal consumption and recreation. In this case water is directed from the Saskatchewan River at Lake Diefenbaker to the Qu'Appelle System and impounded at Buffalo Pound Lake. Therefore water is actually being added to the system. Figure 4 shows the relationship between natural and controlled flows near the outflow of the Saskatchewan River. The controlled flows are determined by many impoundments and flow modifications upstream.

Table 5.2.8
Water Withdrawal and Consumption by Sector, 1981

Sector	Water Intake	Recirculation	Gross Water Use ¹	Consumption	Discharge ²
billions of cubic metres					
Agriculture	3.1		3.1	2.4	0.7
Mineral Extraction	0.8	2.8	3.6	0.2	0.7
Manufacturing	10.2	11.3	21.5	0.5	9.7
Power Generation	19.3	1.9	21.2	0.2	19.2
Municipal	4.4	0.0	4.4	0.6	3.7
Rural Domestic	0.3	0.0	0.3	0.0	0.3
Canada	38.1	16.0	54.1	3.9	34.3

¹ Gross water use equals new water intake plus recycled water.

² Discharge equals water intake minus consumption.

Source:

Environment Canada, Inland Waters Directorate, unpublished data.

Table 5.2.9
Water Withdrawal and Consumption, by Major Drainage Area, 1981

Major Drainage Area	Water Withdrawals						Water Consumption	Percentage of Water Consumption to Water Withdrawal
	Agriculture	Mining	Manufacturing	Power	Municipal	Total		
millions of cubic metres								percent
Atlantic Ocean Coastal ¹	17	90	842	1 625	382	2 956	140	4.7
St. Lawrence River ²	65	3	1 674	308	1 207	3 257	343	10.5
Ottawa River	28	61	352	0	182	623	77	12.4
Lake Ontario Shore ³	42	1	1 288	4 730	885	6 946	231	3.3
Lake Erie and Lake St. Clair Shore	46	11	1 363	4 608	272	6 300	218	3.5
Lake Huron Shore	38	35	1 299	5 300	120	6 792	74	1.1
Lake Superior Shore	3	13	185	292	26	519	9	1.7
Hudson Bay and Ungava Bay Coastal ⁴	0	56	175	0	15	246	11	4.5
Nelson River	0	3	45	0	3	51	0	0.0
Lake Winnipeg Shore	41	29	128	0	124	322	55	17.1
Assiniboine River	171	14	7	579	52	823	175	21.3
Saskatchewan River	2 109	65	223	1 157	402	3 956	1 878	47.5
Mackenzie River	0	115	132	4	10	261	143	54.8
Yukon River	17	10	0	0	5	32	0	0.0
Columbia River	270	31	166	0	65	533	274	51.4
Fraser River	258	51	248	0	380	937	219	23.4
Pacific Ocean Coastal ⁵	0	32	1 633	360	102	2 127	69	3.2
Missouri River	..	..	..	..	..	..	..	..

¹ Here includes Atlantic Ocean Coastal, Gulf of St. Lawrence Coastal, and Bay of Fundy Coastal-Saint John River, also includes the Saguenay Basin.

² Here does not include Saguenay Basin and Upper St. Lawrence Basin near Lake Ontario.

³ Here includes a small portion of the St. Lawrence Basin near Lake Ontario.

⁴ Data not available for Churchill and Thelon-Kazan Basins.

⁵ Includes north and south coastal drainage.

Sources:

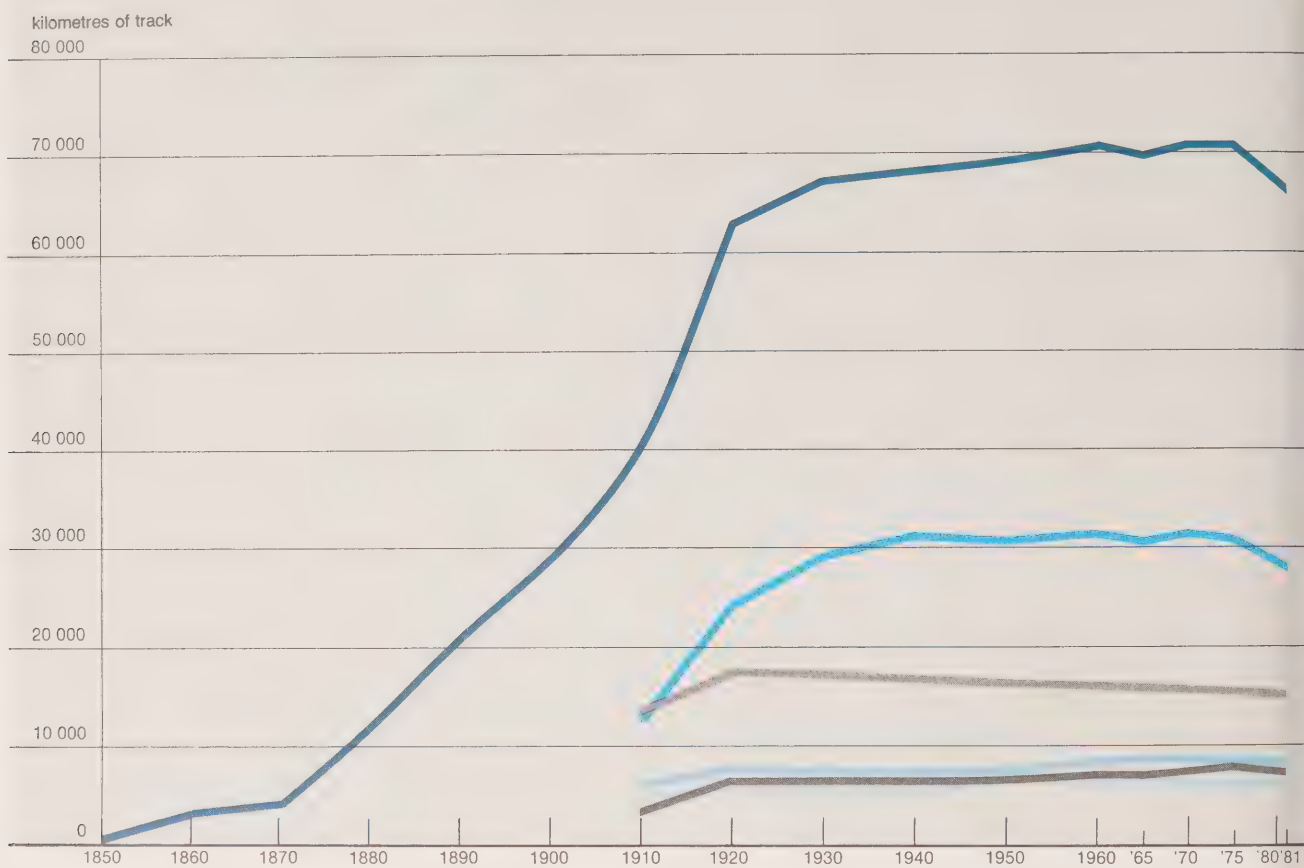
Environment Canada, Inland Waters Directorate, unpublished data.

5.3

Transportation Networks



Chart 5.3.1
Mainline Railroad Track¹ by Region², 1850 to 1981



¹ Mainline or first main track is defined as a single track extending the entire distance between terminals upon which the length of the line is based.

² Data were not available on a regional basis before 1910.

³ Newfoundland included after 1949.

Source:

Statistics Canada, *Railway Transport, Part III*, Catalogue 52-209.

- Canada
- Prairie Provinces
- Ontario
- Québec
- B.C. and Territories
- Atlantic Provinces³

Table 5.3.2
Length of Federal, Provincial and Territorial Roads and Highways, 1982¹

	Freeway ²	Arterial ³	Collector ⁴	Local ⁵	Municipal ⁶	Total
kilometres						
Newfoundland	14	1 027	2 881	5 005	0	8 927
Prince Edward Island	0	464	675	4 180	225	5 544
Nova Scotia	132	2 456	4 741	18 287	28	25 644
New Brunswick	0	2 156	2 343	12 948	40	17 487
Québec	2 594	9 323	8 484	37 814	260	58 475
Ontario	2 083	13 952	5 253	395	1 316	22 999
Manitoba	0	6 552	12 055	421	1 148	20 176
Saskatchewan	13	4 221	4 996	16 272	2 510	28 012
Alberta	750	13 378	2 762	23 250	113 945	154 085
British Columbia	262	11 380	11 735	18 193	861	42 431
Yukon	0	3 912	508	3	42	4 465
Northwest Territories	0	1 623	790	1 134	0	3 547
Canada	5 848	70 444	57 223	137 902	120 375	391 792

¹ Excludes roads under municipal jurisdiction.

² A freeway is a multi-lane divided highway that carries relatively large volumes of traffic at high speeds under free-flow conditions. There is full control of access on a freeway with access only at grade-separated interchanges. Freeways provide service within urban areas and also connect major centres and areas of major economic importance either within the province or to adjacent provinces or states. Relatively large volumes of traffic and free-flow conditions are the key elements of freeway classification.

³ An arterial is a highway, either two-lane or multi-lane, that carries significant volumes of traffic at high speeds, provides service within urban areas and connects major economic areas, cities, towns and points of entry. The primary function of arterials is traffic movement. Some degree of access control is usually applied to regulate or eliminate direct land access. Land access is subservient to the main function of traffic movement.

⁴ A collector is a highway that gives equal importance to the traffic movement and land service functions. Collectors form an integrated network throughout developed areas and provide traffic service to resource and resort areas, industrial concentrations, smaller towns and villages, and generally collect traffic from local roads and feed it to arterial roads or distribute traffic from arterial to locals. Access may be regulated. Traffic volumes may vary over a wide range but are generally less than freeways and arterials.

⁵ A local is a highway that has land access as its primary function. Access points may be frequent, both to adjacent land and at street and road intersections. Generally traffic volumes are significantly lower than for other classifications.

⁶ A municipal road is defined as any road within the boundaries of an incorporated municipal unit or under the control of a local board that is funded jointly by the municipal, provincial, and/or federal governments or totally by the municipal government. Here they correspond mainly to Indian reserve roads. The high number for Alberta corresponds mainly to Improvement District Roads.

Source:

Statistics Canada, *Report on Federal, Provincial and Territorial Roads and Highways — Length and Expenditure, 1981-82*, Catalogue 53-006

Map 5.3.3
Evolution of the Northern Road Network



Operating Roads

1. Dempster Highway
2. Klondike Highway
3. Alaskan Highway
4. Campbell Highway
5. Canol Road
6. Liard Highway
7. Mackenzie Highway
8. Yellowknife Highway
9. Fort Smith Highway

Period of Construction

- Before 1965
- Between 1965 and 1975
- After 1975
- - - Proposed
- ... Winter roads

Proposed Roads

- A Inuvik-Tuktoyaktuk extension
- B Mackenzie Highway to Inuvik
- C Mackenzie Highway to Norman Wells

Source:
Department of Indian and Northern Affairs.

Table 5.3.4
Aerodromes and Heliports, 1980¹

Province or Territory	Aerodromes in Operation by Length of Longest Runway				Total	Aerodromes Abandoned	Heliports
	Less than 914 Metres	914 to 1 524 Metres	1 525 to 2 134 Metres	More than 2 134 Metres			
Newfoundland	13	5	3	4	25	3	3
Prince Edward Island	1	1	1	1	4	0	1
Nova Scotia	9	3	1	4	17	0	2
New Brunswick	14	9	4	2	29	1	5
Québec	56	47	30	8	141	5	25
Ontario	105	57	18	6	186	1	29
Manitoba	75	21	6	1	103	8	9
Saskatchewan	132	27	1	3	163	6	3
Alberta	137	67	14	5	223	4	12
British Columbia	90	47	24	3	164	3	18
Yukon	22	14	9	0	45	4	2
Northwest Territories	29	53	17	2	101	43	0
Total	683	351	128	39	1 201	78	109

¹ Includes all public, private and military aerodromes and heliports.

Source:

Energy, Mines and Resources Canada, Surveys and Mapping Branch, *VFR Chart Supplement*, 1980.

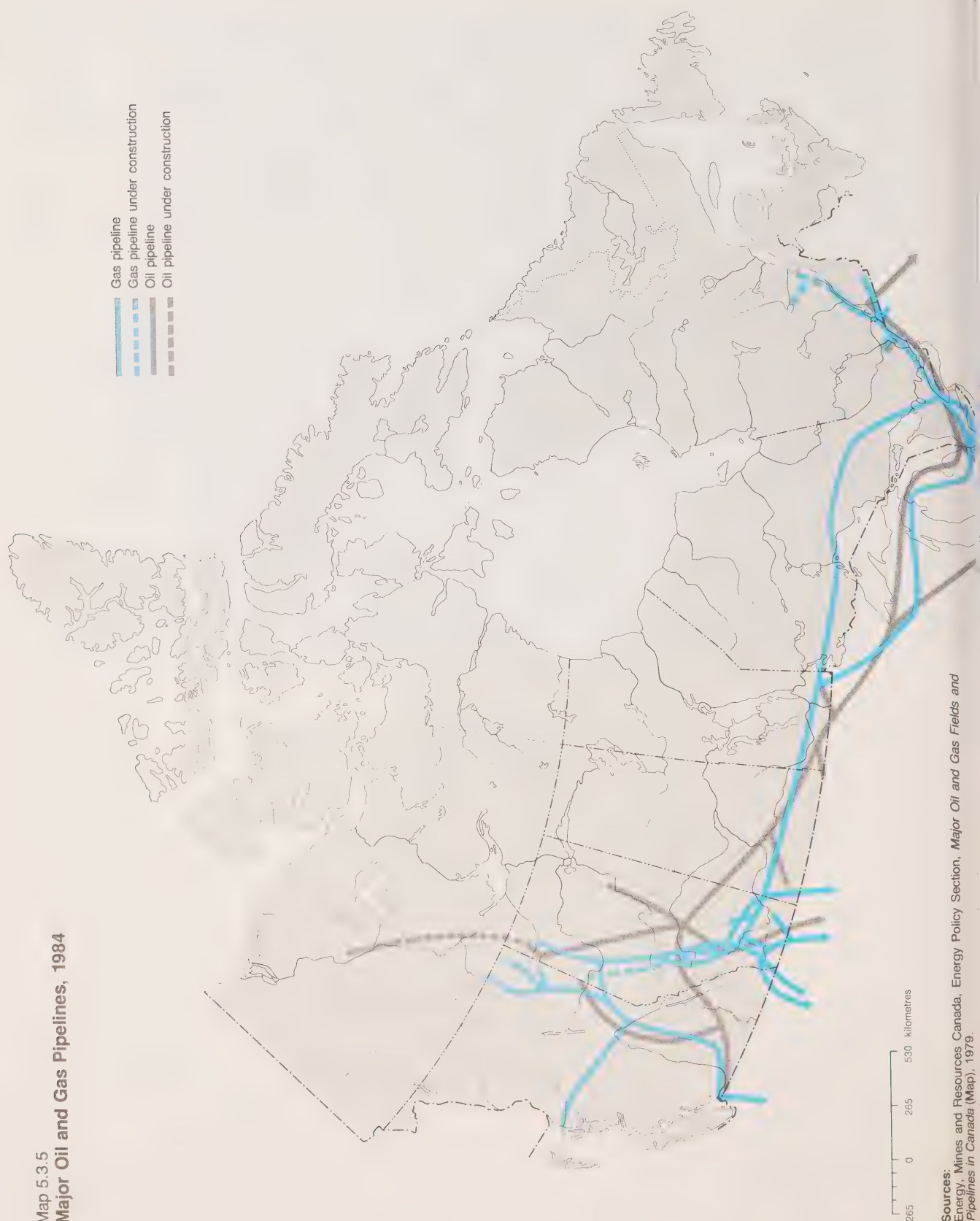
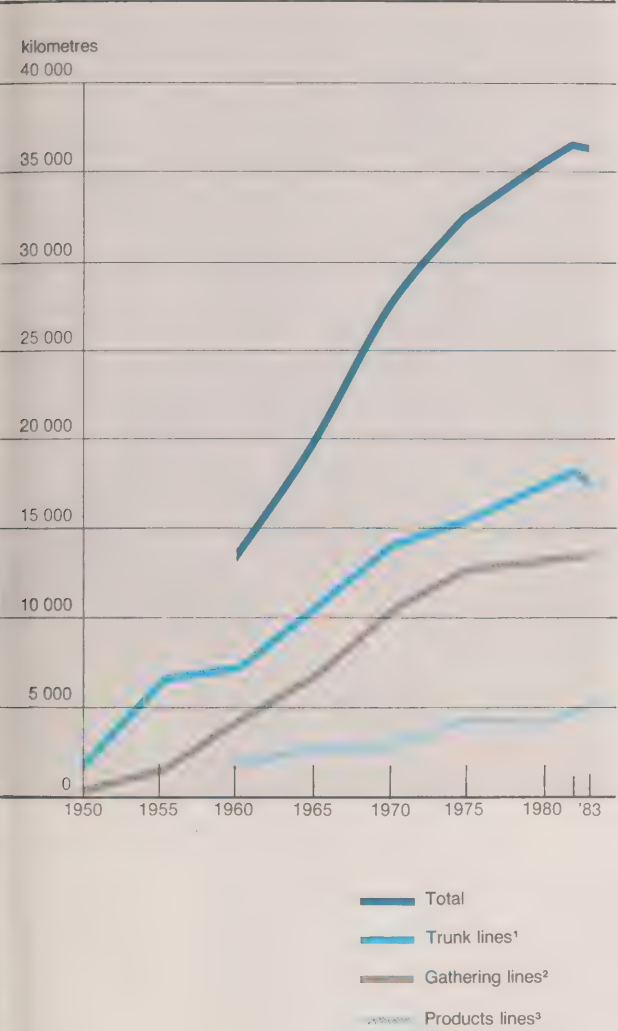


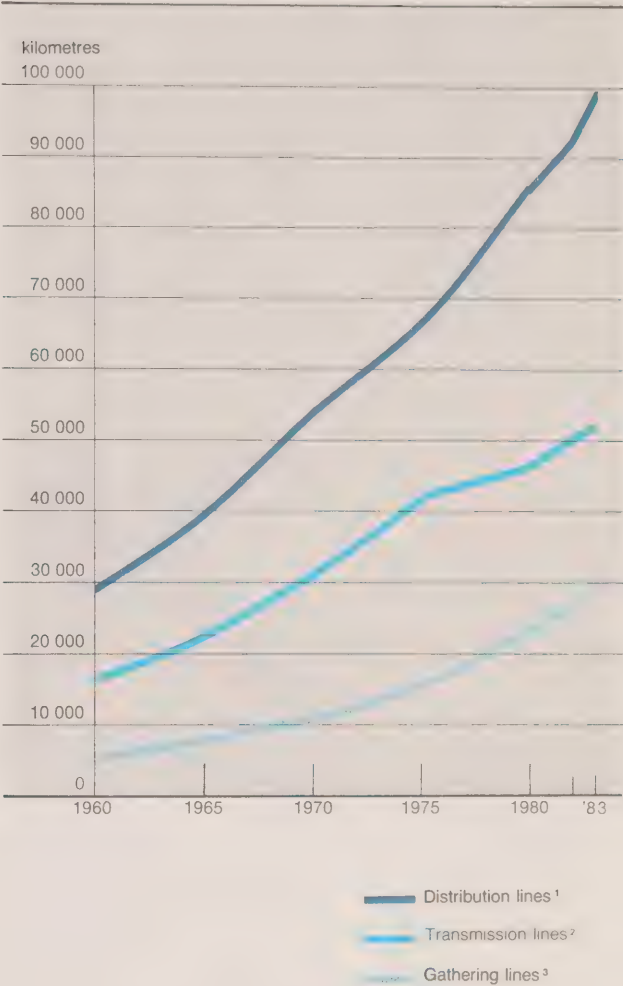
Chart 5.3.6
Length of Oil Pipelines, 1950 to 1983



¹ Main transporting lines for unrefined oil.
² Secondary transporting lines operating within oil fields and carrying unrefined oil.
³ Lines built to carry refined products such as gasoline or fuel oil.

Source:
Statistics Canada, *Oil Pipeline Transport*, Catalogue 55-201.

Chart 5.3.7
Length of Natural Gas Pipelines, 1960 to 1983



¹ Lines carrying gas from the point of local supply to the point of use.
² Main transporting lines installed for the purpose of carrying gas from a source of supply to one or more distribution centers, or to one or more large volume customers. They may also be installed to connect sources of supply.
³ Secondary transporting lines to carry gas from individual wells to compressor stations, or to/from main transmission lines.

Source:
Statistics Canada, *Gas Utilities: Transport and Distribution Systems*, Catalogue 57-205.

Map 5.3.8
Major Electric Transmission Lines

200-399 kilovolts, existing
400 kilovolts or greater, existing
200-399 kilovolts, under construction
400 kilovolts or greater, under construction



Source: Energy, Mines and Resources Canada, *National Atlas of Canada, fifth edition, Electricity Generation and Transmission (Map)* (Ottawa, 1983)

Table 5.3.9
Length of Electric Transmission Circuit by Power Line Voltage, 1956 to 1982

Power Line Voltage	1956	1961	1966	1971	1976	1981	1982
kilometres							
20-99 kilovolts	60 524	66 239	71 545	78 857	77 718	77 218	76 151
100-199 kilovolts	20 768	26 912	33 462	40 360	42 996	47 861	48 007
200-299 kilovolts	7 076	9 257	13 228	23 641	29 386	33 373	34 764
300-399 kilovolts	1 466	3 750	4 361	5 810	6 827	7 504	7 695
400-599 kilovolts	..	..	702	2 530	5 480	8 691	8 828
600 kilovolts and over	..	..	1 003	1 968	4 879	7 970	8 826
Total Transmission Circuit	89 834	106 158	124 301	153 166	167 286	182 617	184 271

Source:
Statistics Canada, *Electric Power Statistics*, Catalogue 57-202.

5.4

Resource Development



Map 5.4.1
Major Resource Projects

- Oil and gas
- ▲ Hydro-electric generation and distribution
- Industrial minerals
- Metal minerals

Map numbers refer to specific projects
in Tables 5.4.2 to 5.4.5



Source: Department of Industry, Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, *Major Projects Inventory*, Ottawa, 1983 and unpublished

Table 5.4.2
Major Resource Projects¹ - Oil and Gas

Map Number	Status Committed (C) Planned (P) (1984)	Ecozone ²	Project	Sponsor(s)	Investment millions of 1982 dollars	Start/ Completion
1	C	Atlantic Maritime*	Scotian Shelf Exploration: Program 1	Petro Canada Explorations, 50%; Bow Valley, 25%; Husky Oil 25%	500	1982/1985
2	C	Atlantic Maritime*	Scotian Shelf Exploration: Program 2	Shell Canada Resources plus seven other participants	551	1982/1985
3	C	Atlantic Maritime*	Sable Island Exploration	Mobil Oil Canada	270	1984/1986
4	C	Atlantic Maritime*	Scotian Slope Exploration	Shell Canada Resources and others	263	1982/1987
5	C	Atlantic Maritime*	East Sable and Northumberland Blocks Exploration	Dome Petroleum and partners	127	1983/1985
6	C	Mixed-Wood Plain	Québec Natural Gas Distribution Network	Gaz Métropolitain, Gaz Inter-Cité Québec	1 000	1982/1986
7	C	Boreal Plain	Wolf Lake Oil Sands	B.P. Exploration Canada, 50%; Petro Canada, 50%	200	1983/1985
8	C	Boreal Plain	Cold Lake Oil Sands: Phase 1	Esso Resources Canada	250	1983/1985
9	C	Taiga Plain	Norman Wells Oil Development	Esso Resources Canada	630	1982/1985
10	C	Taiga Plain	Norman Wells Oil Pipeline	Interprovincial Pipe Line (N.W.)	467	1983/1985
11	C	Southern Arctic*	Dome Beaufort Exploration	Dome Petroleum	969	1982/1987
12	C	Southern Arctic*	Esso Beaufort Exploration	Esso Resources Canada, Home Oil	500	1981/1985
13	C	Southern Arctic*	Gulf Beaufort Drilling	Gulf Canada Resources	674	1981/1988
14	C	Southern Arctic*	Gulf Beaufort Exploration	Gulf Canada Resources and others	1 100	1983/1987- 89
15	C	Northern Arctic	Arctic Exploration	Panarctic Oils	700	1982/1985
16	C	Arctic Cordillera*	Davis Strait Exploration	Canterra Energy and others	200	1982/1986
17	P	Atlantic Maritime*	Offshore Sable Island- Venture Gas Development	Mobil Oil Canada, Petro Canada and others	2 000	1985/1989
18	P	Boreal Shield*	Hibernia Oil Development	Mobil Oil Canada, Petro Canada, Gulf Canada and others	6 000	1985/1989
19	P	Prairie, Boreal Plain	Alberta Gas Pipeline Expansion	Nova	1 200	1982/1991
20	P	Boreal Cordillera, Montane Cordillera, Pacific Maritime	Canada LNG-Natural Gas Pipeline	NIC Resources & Union Oil	1 060	1985/1989
21	P	Boreal Plain	Peace River Oil Sands Development	Shell Canada Resources	..	1984/1988
22	P	Southern Arctic, Taiga Plain, Boreal Plain, Prairie	Beaufort Sea/Edmonton Oil Pipeline	..	2 000	1985/1991
23	P	Southern Arctic*	Gulf Beaufort Sea Oil Development	Gulf	4 000	1985/1991
24	P	Southern Arctic	Dome Beaufort Sea Oil Pilot Development	Dome Petroleum Ltd.	400	1983/1987

¹ A major resource project is defined as one with a minimum investment value of \$100 million. Projects included here are committed or planned projects. For the purposes of the inventory committed projects are deemed to be 90 percent to 100 percent probable. They are: (a) under construction or (b) about to be started or (c) have received all necessary approvals from appropriate government regulatory agencies to allow it to proceed, or (d) have been given approval by the company's board to be started. Planned projects are deemed to be 60 percent to 90 percent probable. They have received company approval, in principle, and are currently being studied to confirm economic marketing and technical viability.

² Ecozones are terrestrial units; for offshore developments closest land ecozone is identified and starred*.

Sources:

Department of Industry, Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, *Major Projects Inventory*, Ottawa, 1983.

Department of Industry Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, unpublished information, 1984.

Table 5.4.3

Major Resource Projects¹ - Hydro Electricity Generation and Distribution

Map Number	Status Committed (C) Planned (P) (1984)	Ecozone	Project	Sponsor	Investment millions of 1982 dollars	Start/ Completion
25	C	Mixed-Wood Plain	NEPOOL Electric Power Line	Hydro-Québec	300	1983/1986
26	C	Boreal Shield	Cat Arm Hydroelectric Project	Newfoundland and Labrador Hydro	450	1981/1985
27	C	Boreal Shield	Madawaska Electric Power Lines	Hydro-Québec	100	1983/1985
28	C	Boreal Shield	Manic 5 Hydro Site Expansion	Hydro-Québec	500	1984/1989
29	C	Boreal Shield	St. Mary's River Hydro Generation	Great Lakes Power Ltd.	115	1979/1982
30	C	Boreal Shield	Nelson River Transmission Network	Manitoba Hydro	144	1980/1985
31	C	Boreal Plain	Nipawin Hydro Station	Saskatchewan Power	490	1981/1986
32	C	Montane Cordillera	Revelstoke Canyon Hydro	B.C. Hydro	1 280	1976/1984
33	C	Pacific Maritime	Cheekye-Dunsmuir Transmission Network	B.C. Hydro	610	1980/1984
34	C	Taiga Shield	La Grande, Phase 1	Hydro-Québec	9 000	1974/1985
35	C	Taiga Shield, Boreal Shield	James Bay Transmission Network	Hydro-Québec	3 719	1978/1985
36	P	Mixed-Wood Plain	Delaney Hydro Project	Hydro-Québec	961	1986/1993
37	P	Boreal Shield	Limestone Hydro Station	Manitoba Hydro	1 171	1985/1992
38	P	Montane Cordillera	Keenleyside/Murphy Creek Hydro Development	B.C. Hydro	975	1990/1997
39	P	Pacific Maritime	Kelly Lake-Cheekye Transmission Network	B.C. Hydro	230	1986/1990
40	P	Boreal Cordillera	Peace Site 'C' Hydro Development	B.C. Hydro	1 370	1991/1998
41	P	Taiga Shield	Lower Churchill, Phase I	Lower Churchill Development Corp.	3 100	1988/1993
42	P	Taiga Shield	Grande Baleine Complex	Hydro-Québec	2 845	1988/1999
43	P	Taiga Shield	La Grande, Phase 2	Hydro-Québec	1 000	1988/1997

¹ A major resource project is defined as one with a minimum investment value of \$100 million. Projects included here are committed or planned projects. For the purposes of the inventory committed projects are deemed to be 90 percent to 100 percent probable. They are: (a) under construction or (b) about to be started or (c) have received all necessary approvals from appropriate government regulatory agencies to allow it to proceed, or (d) have been given approval by the company's board to be started. Planned projects are deemed to be 60 percent to 90 percent probable. They have received company approval, in principle, and are currently being studied to confirm economic marketing and technical viability.

Sources:

Department of Industry, Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, *Major Projects Inventory*, Ottawa, 1983.
Department of Industry Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, unpublished information, 1984.

Table 5.4.4

Major Resource Projects¹ - Metal Mining

Map Number	Status: Committed (C) Planned (P) (1984)	Ecozone	Project	Sponsor(s)	Investment millions of 1982 dollars	Start/ Completion
44	C	Atlantic Maritime	East Kemptville, N.S. Tin Mine	Rio Algom	161	1983/1985
45	C	Boreal Shield	Hemlo Gold Mine	Lac Minerals	237	1983/1986
46	C	Boreal Shield	Hemlo Gold Mine	Noranda, Golden Sceptre, Goliath	228	1983/1985
47	C	Boreal Shield	Detour Lake Gold Mine	Campbell Red Lake Mines, 25%; Dome Mines, 25%; Amoco Canada, 50%	240	1980/1987
48	C	Boreal Shield	Denison Uranium Mine Expansion	Denison Mines	300	1978/1984
49	C	Boreal Shield	Rio Algom Uranium Mine Rehabilitation	Rio Algom Ltd.	100	1979/1984
50	C	Boreal Shield	Thompson Open Pit Nickel Mine	INCO	120	1982/1989
51	C	Boreal Shield	Key Lake Uranium Mine	Key Lake Mining Corporation	500	1981/1984
52	P	Montane Cordillera	Equity Silver Mine ²	Equity Silver Mines Ltd.	147	1983/1984
53	P	Pacific Maritime	Westmin H-W Mine ²	Westmin Resources	150	1983/1985
54	P	Tundra Cordillera	Mactung Mine	Amex Northwest Mining	200	1984/1986

Table 5.4.4
Major Resource Projects¹ - Metal Mining

¹ A major resource project is defined as one with a minimum investment value of \$100 million. Projects included here are committed or planned projects. For the purposes of the inventory committed projects are deemed to be 90 percent to 100 percent probable. They are: (a) under construction or (b) about to be started or (c) have received all necessary approvals from appropriate government regulatory agencies to allow it to proceed, or (d) have been given approval by the company's board to be started. Planned projects are deemed to be 60 percent to 90 percent probable. They have received company approval, in principle, and are currently being studied to confirm economic marketing and technical viability. Status in 1983.

Sources:
Department of Industry Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, *Major Projects Inventory*, Ottawa, 1983.
Northern Miner, New Mining Projects, July 19, 1984.

Table 5.4.5
Major Resource Projects¹ - Industrial Minerals

Map Number	Status Committed (C) Planned (P) (1983)	Ecozone	Project	Sponsor(s)	Investment millions of 1982 dollars	Start/ Completion
55	C	Atlantic Maritime	Sussex Potash Mine	Potash Company of America	285	1980/1985
56	C	Prairie	Potash Mine Expansion-Lanigan Phase 2	Potash Corporation of Saskatchewan	450	1979/1984
57	C	Boreal Plain	Genesee Thermal Coal Mine	Fording Coal Ltd. and others	250	1983/1986
58	C	Montane Cordillera	Line Creek Coal Mine	Crows Nest Resources Ltd.	330	1979/1983
59	C	Montane Cordillera	Greenhills Surface Coal Project	B.C. Coal Ltd., 80%; Pohang Iron and Steel Co., 20%	282	1981/1983
60	C	Montane Cordillera	Gregg River Open Pit Coal Mine	Gregg River Resources Ltd.	190	1981/1983
61	C	Montane Cordillera	Eagle Mountain Coal Mine Expansion	Fording Coal Ltd.	115	1982/1983
62	C	Boreal Cordillera	Quinette Coal Development	Quinette Coal Ltd.	838	1981/1984
63	C	Boreal Cordillera	Bullmoose Coking Coal Project	Teck Corp., Lornex Mining and others	290	1981/1983
64	P	Atlantic Maritime	Donkin Morien Colliery	Cape Breton Development Corp.	100 +	1980/1991
65	P	Atlantic Maritime	Glace Bay Colliery	Cape Breton Development Corp.	100 +	1983/1993
66	P	Atlantic Maritime	Lingan-Phelan Mine	Cape Breton Development Corp.	100 +	1983/1985
67	P	Prairie	Sherness Thermal Coal Mine	Luscar Ltd. and Manalta Coal Ltd.	200	
68	P	Prairie	Buffalo Hill Coal Project	Seagull Resources Ltd.	120	.../1987
69	P	Boreal Plain	Coalspar Thermal Coal Development	Dentherm Resources	400	1983/1986
70	P	Boreal Plain	McLeod River Coal Project	McLeod River Coal Ltd., 70%; Electric Power Development Co. of Japan, 30%	325	1984/1986
71	P	Boreal Plain	Obed Marsh Thermal Coal	Union Oil of Canada, Norcen Energy	300	1983/1985
72	P	Boreal Plain	Mercoal Project	Mercoal Minerals Ltd., 80%; Idemitsukosan, Ltd., 20%	235	1984/1986
73	P	Boreal Plain	Hinton East Coal Mine	Esso Resources Canada Ltd.	175	1984/1987
74	P ²	Montane Cordillera	Elk River Coal Mine	Elco Mining	475	.../1989
75	P	Montane Cordillera	Line Creek Coal Expansion	Crows Nest Resources Ltd.	250	1984/1986
76	P	Boreal Cordillera	Monkman Coal Project	Petro Canada, 50%; Canadian Superior Oil, 33.3%; McIntyre Mines, 16.7%	620	1983/1986
77	P	Pacific Maritime	Quinsam Coal Mine	Quinsam Coal Ltd.	100	1983/1985

¹ A major resource project is defined as one with a minimum investment value of \$100 million. Projects included here are committed or planned projects. For the purposes of the inventory committed projects are deemed to be 90 percent to 100 percent probable. They are: (a) under construction or (b) about to be started or (c) have received all necessary approvals from appropriate government regulatory agencies to allow it to proceed, or (d) have been given approval by the company's board to be started. Planned projects are deemed to be 60 percent to 90 percent probable. They have received company approval, in principle, and are currently being studied to confirm economic marketing and technical viability.

² Status in 1984.

Source:
Department of Industry Trade and Commerce and Regional Economic Expansion, Office of Industrial and Regional Benefits, *Major Projects Inventory*, Ottawa, 1983.
Northern Miner, New Mining Projects, July 19, 1984

Table 5.4.6
Land Area Utilized by Mining¹

Province/ Territory	Metallic and Non-Metallic	Uranium	Asbestos	Potash	Coal	Oil Sands	Construction Materials	Total
hectares								
Newfoundland	4 880	...	297	...	...	...	2 750	7 927
Prince Edward Island	...	...	...	...	...	...	575	575
Nova Scotia	1 150	...	...	...	495	...	4 025	5 670
New Brunswick	1 450	...	...	...	6 100	...	3 450	11 000
Québec	21 885	...	3 525	...	...	...	31 050	56 460
Ontario	48 420	1 174	173	...	...	...	46 000	95 767
Manitoba	1 986	...	...	...	...	...	10 350	12 336
Saskatchewan	411	279	...	4 110	6 660	...	12 650	24 110
Alberta	...	...	...	...	8 280	4 850	10 500	23 630
British Columbia	18 115	...	...	...	6 175	...	16 675	40 965
Yukon and Northwest Territories	5 650	...	237	...	...	...	...	5 887
Canada	103 947	1 453	4 232	4 110	27 710	4 850	138 025	284 327

¹ Includes land area disturbed by mine wastes and facilities and those land areas alienated from alternate uses due to their proximity to, or encirclement by, mine wastes or fixed facilities.

Source:

Environment Canada, Lands Directorate, *Mining, Land Use and the Environment*, 1. A Canadian Overview by I.B. Marshall, Ottawa, 1982.

Note:

These area estimates exclude townsites and road/rail access routes. The environmental impact of mining activity can be analysed in terms of direct effects (ie. land use, transport of minerals) and indirect effects (ie.

establishment of new settlements, the requisite infrastructure to maintain them and the socio-cultural activities of the inhabitants, hunting and fishing for example). These impacts are generally different in remote wilderness areas from those in already settled areas. In the latter the impacts are associated with the competition for alternative land uses and the living conditions of the population surrounding the site (quarrying around urban areas, for example) whereas in the former the impacts relate to stress on habitats and ecosystem stability.

6

Generation of Waste Residuals



Contents

6.1	Mining	215
6.2	Manufacturing	223
6.3	Thermal Energy Generation	239
6.4	Transportation Activity	247
6.5	Household Consumption and Municipal Wastes	255
6.6	Multiple Source Stress	261

Tables

6.1.1	Mining Activity by Ecozone, 1981	216
6.1.2	Mining Activity by Major Drainage Area, 1971, 1976 and 1981	217
6.1.3	Consumption of Fuel and Electricity by Mining Industries, by Ecozone, 1976 and 1981	219
6.1.4	Consumption of Fuel and Electricity by Mining Industries, by Major Drainage Area, 1976 and 1981	220
6.1.5	Metal Mining Waste Generation by Ecozone, 1981	221
6.1.6	Coal Mining Rock Waste Generation by Ecozone, 1981	222
6.2.1	Manufacturing Activity by Stressor Type: Stress to Air, 1971, 1976 and 1981	226
6.2.2	Manufacturing Activity by Stressor Type: Stress to Water, 1971, 1976 and 1981	226
6.2.3	Manufacturing Activity by Ecozone, 1981	227
6.2.4	Manufacturing Activity by Stressor Type: Stress to Water, by Major Drainage Area, 1973, 1976 and 1981	228
6.2.6	Consumption of Fuel and Electricity by Manufacturing Industries, by Ecozone, 1976 and 1981	231
6.2.7	Consumption of Fuel and Electricity by Manufacturing Industries, by Major Drainage Area, 1976 and 1981	232
6.2.8	Heavy Metals: Major End Use by Manufacturing Industries, 1961 to 1982	233
6.2.10	Manufacturing Water Use by Industry Group, 1981	234
6.2.11	Manufacturing Water Use by Major Drainage Area, 1976	235
6.2.13	Pollutants Loadings to Water by Pulp and Paper Mills, by Major Drainage Area, 1973, 1976 and 1982	236
6.2.14	Water Pollution Compliance Levels of Pulp and Paper Mills, by Major Drainage Area, 1982	237
6.3.2	Generation of Electricity by Province/Territory, 1982	241
6.3.3	Fuel Consumption by Thermal Generating Stations, 1961 to 1982	241
6.3.4	Fuel Consumption by Thermal Generating Stations, by Ecozone, 1981	242
6.3.5	Consumption of Coal by Thermal Generating Stations and Other Industries, by Ecozone, 1981	243
6.4.4	Airport Activity: Aircraft Movements by Weight Classes, 1983	250
6.4.5	Estimated Population Affected by Aircraft Noise Around Selected Airports, 1976	250
6.4.7	Cargo Movements through Canadian Ports, 1935 to 1983	252
6.4.8	Total Cargo and Petroleum Products Handled in Canadian Ports, 1981	252
6.4.10	Energy Consumed by Transportation Mode, 1958 to 1983	253
6.4.11	Gasoline Production and Lead Use, 1975 to 1983	254
6.5.1	Population Served by Municipal Wastewater Treatment Systems, by Major Drainage Area	256
6.5.2	Estimated Daily Waste Discharged from Municipalities, by Major Drainage Area	257
6.5.3	Private Occupied Dwellings by Principal House Heating Fuel, by Ecozone, 1981	258
6.5.5	High Energy Consuming Household and Recreational Goods, 1960 to 1984	259
6.6.7	Trends in Emissions of Sulphur Dioxide	267
6.6.8	Trends in Emissions of Nitrogen Oxides	267
6.6.10	Annual Air Quality Index for Selected Locations in Canadian Cities, 1974 to 1983	268
6.6.18	Phosphorus Loadings to the Great Lakes, 1976 to 1982	276
6.6.23	Phosphorus Loadings to Okanagan Drainage Basin Lakes, 1970 and 1980	280
6.6.24	Phosphorus Concentrations in Okanagan Drainage Basin Lakes, 1970 to 1980	280
6.6.27	Surface Water Area by Potential to Reduce Acidity and Sulphate Deposition in Eastern Canada	283
6.6.29	Spills of Hazardous Materials by Source, 1974 to 1979	284

Maps

6.2.5	Production Workers in High Stressor Manufacturing Industries, by Drainage Basin, 1981	230
6.3.7	Thermal Electric Generating Stations, 1983	245
6.3.8	Nuclear Generating Stations in the St. Lawrence-Great Lakes Basin, 1984	246

6.4.6	Noise Exposure Forecasts for Ottawa International Airport, 1976 and 1988	251
6.6.2	Magnitude and Distribution of Sulphur Dioxide Emissions, 1978	264
6.6.3	Magnitude and Distribution of Nitrogen Oxides Emissions, 1978	264
6.6.4	Magnitude and Distribution of Hydrocarbon Emissions, 1978	265
6.6.5	Magnitude and Distribution of Carbon Monoxide Emissions, 1978	265
6.6.6	Magnitude and Distribution of Particulate Matter Emissions, 1978	266
6.6.14	Detection of the Herbicide 2,4-D in Prairie Rivers (from NAQUADAT Monitoring Stations), 1980 to 1982	272
6.6.15	Phosphorus in Canadian Rivers (from NAQUADAT Monitoring Stations), 1971 to 1973	273
6.6.16	Phosphorus in Canadian Rivers (from NAQUADAT Monitoring Stations), 1980 to 1982	274
6.6.21	Nutrient Enrichment of the Great Lakes	279
6.6.22	Lakes in the Okanagan Drainage Basin	279
6.6.25	Acidity of Precipitation in the United States and Canada, 1981	281
6.6.26	Sulphate Deposition and Sensitivity of Waters to Acid Precipitation in Eastern Canada	282
6.6.28	Eastern Canada Sulphate Deposition Study Area	283

Charts

6.2.9	Lead Used by Manufacturing Industries, by Major Drainage Area, 1981	233
6.2.12	Hazardous Waste Generated by Manufacturing Industries	235
6.2.15	Pollutant Loadings to Water by Petroleum Refineries, 1972 to 1980	238
6.2.16	Mercury Loadings to Water by Chlor-Alkali Plants, 1972 to 1983	238
6.3.1	Generation of Electricity, 1961 to 1982	240
6.4.1	Motor Vehicles, 1910 to 1982	248
6.4.2	Railroad and Aircraft Passenger Kilometres, 1940 to 1981	248
6.4.3	Passengers Carried by Transportation Mode, 1974 to 1981	249
6.4.9	Oil and Gas Movements by Pipelines, 1950 to 1983	253
6.6.9	Sources and Emission of Lead to the Atmosphere, 1978	268
6.6.12	Trends in Selected Air Pollutants in Toronto, Montréal and Vancouver	270
6.6.17	Distribution of Phosphorus Loadings Relative to Great Lakes Volume, 1982	275
6.6.19	Lower Great Lakes Municipal Phosphorus Loads, 1972 to 1983	277
6.6.20	Phosphorus Concentrations in Lake Ontario, 1970 to 1982	278

Technical Boxes

6.3.6	Composition of Canadian Coals	244
6.5.4	Major Air Contaminant Emissions from Residential Heating, 1980	259
6.6.1	Energy Intensity of Industrial Processes: an Indicator of Environmental Stress	262
6.6.11	National Air Quality Objectives	269
6.6.13	Water Quality and the National Water Quality Data Bank	271

6.1

Mining



Table 6.1.1
Mining Activity¹ by Ecozone, 1981²

Ecozone	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵
Atlantic Maritime	8	2 550	14	3 500-3 999	45	1 240	20	348	87	7 500-7 999
Nova Scotia	2	100-199	13	3 471	8	606	7	169	30	4 000-4 499
New Brunswick	3	1 868	1	200-499	13	259	8	140	25	2 500-2 999
Québec	3	500-999	0	0	24	375	5	39	32	500-999
Mixed-Wood Plain	0	0	0	0	31	5 578	154	2 180	185	7 758
Québec	0	0	0	0	20	4 634	80	906	100	5 540
Ontario	0	0	0	0	11	944	74	1 274	85	2 218
Boreal Shield	67	32 799	0	0	15	1 011	22	178	104	33 988
Newfoundland	3	570	0	0	4	542	1	1-99	8	1 000-1 499
Québec	31	8 312	0	0	7	100-199	11	81	49	8 500-8 999
Ontario	28	20 450	0	0	3	126	9	87	40	20 663
Manitoba	4	3 000-3 499	0	0	1	100-199	1	1-99	6	3 403
Saskatchewan	1	200-499	0	0	0	0	0	0	1	200-499
Prairie	0	0	9	500-999	19	3 766	13	100-199	41	4 445
Manitoba	0	0	0	0	1	1-99	6	6-99	7	73
Saskatchewan	0	0	6	400	16	3 500-3 999	1	1-99	23	4 114
Alberta	0	0	3	100-199	2	2-99	6	103	11	268
Boreal Plain	3	877	5	1 224	7	236	1	1-99	16	2 000-2 499
Manitoba	1	200-499	0	0	1	1-99	1	1-99	3	359
Saskatchewan	2	500-999	0	0	1	1-99	0	0	3	584
Alberta	0	0	5	1 224	5	100-199	0	0	10	1 000-1 499
Montane Cordillera	21	5 414	5	3 500-3 999	2	2-99	2	2-99	30	9 243
Alberta	0	0	2	500-999	0	0	0	0	2	500-999
British Columbia	21	5 414	3	2 767	2	2-99	2	2-99	28	8 000-8 499
Pacific Maritime	7	1 633	0	0	3	80	7	100-199	17	1 500-1 999
British Columbia	7	1 633	0	0	3	80	7	100-199	17	1 500-1 999
Boreal Cordillera	6	928	0	0	1	200-499	0	0	7	1 000-1 499
British Columbia	3	90	0	0	1	200-499	0	0	4	500-999
Yukon	3	838	0	0	0	0	0	0	3	838
Tundra Cordillera	1	100-199	0	0	0	0	0	0	1	100-199
Northwest Territories	1	100-199	0	0	0	0	0	0	1	100-199
Taiga Plain	1	200-499	0	0	0	0	0	0	1	200-499
Northwest Territories	1	200-499	0	0	0	0	0	0	1	200-499
Taiga Shield	10	4 733	0	0	1	100-199	0	0	11	4 500-4 999
Newfoundland	3	3 356	0	0	0	0	0	0	3	3 356
Québec	1	1-99	0	0	1	100-199	0	0	2	100-199
Saskatchewan	1	500-999	0	0	0	0	0	0	1	500-999
Northwest Territories	5	816	0	0	0	0	0	0	5	816
Northern Arctic	1	100-199	0	0	0	0	0	0	1	100-199
Northwest Territories	1	100-199	0	0	0	0	0	0	1	100-199
Canada	125	49 586	33	9 188	124	12 557	219	3 109	501	74 440

¹ Excludes crude petroleum and natural gas industry and services incidental to mining.

² Ranges are used to meet the confidentiality restrictions of the Statistics Act.

³ Includes asbestos, salt, potash, sulfur and miscellaneous non-metallic mineral mines.

⁴ The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industry statistics.

⁵ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

Source:

Energy, Mines and Resources Canada, Annual Census of Metal Mines, Non-Metal Mines, and Sand Pits and Quarries, 1981.

Statistics Canada, Annual Census of Coal Mines, 1981.

Statistics Canada, Office of the Senior Adviser on Integration, special tabulations.

Table 6.1.2
Mining Activity¹ by Major Drainage Area, 1971, 1976 and 1981²

Major Drainage Area	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵
Atlantic Ocean Basin										
1971	53	29 000-29 499	7	3 000-3 499	86	8 467	255	3 598	401	44 247
1976	39	29 627	11	3 000-3 499	79	7 500-7 999	234	3 500-3 999	363	44 867
1981	45	26 387	14	3 500-3 999	89	7 658	195	2 701	342	40 466
Atlantic Ocean Coastal										
1971	7	3 374	0	0	2	200-499	6	6-99	15	3 936
1976	5	4 261	0	0	3	868	6	141	14	5 270
1981	5	3 802	0	0	2	200-499	5	5-99	12	4 360
Gulf of St. Lawrence Coastal										
1971	9	4 174	6	2 929	30	1 009	6	48	51	8 160
1976	10	6 522	9	3 218	27	885	3	35	49	10 660
1981	11	5 682	13	3 471	29	709	5	44	58	9 906
Bay of Fundy Coastal and Saint John River										
1971	0	0	1	200-499	5	308	12	100-199	18	688
1976	1	1-99	2	200-499	5	267	10	246	18	861
1981	2	100-199	1	200-499	5	345	9	195	17	892
St. Lawrence River										
1971	3	441	0	0	34	5 659	120	1 534	157	7 634
1976	1	100-199	0	0	29	4 818	98	1 500-1 999	128	6 453
1981	2	500-999	0	0	38	5 054	90	500-999	130	6 624
Ottawa River										
1971	20	3 356	0	0	4	174	13	218	37	3 748
1976	11	2 036	0	0	3	135	12	222	26	2 393
1981	17	2 340	0	0	1	1-99	10	100-199	28	2 486
Lake Ontario Shore										
1971	2	200-499	0	0	4	100-199	55	1 033	61	1 689
1976	2	500-999	0	0	5	100-199	60	1 129	67	1 861
1981	0	0	0	0	4	231	46	837	50	1 068
Lake Erie and Lake St. Clair Shore										
1971	0	0	0	0	4	348	28	400	32	748
1976	0	0	0	0	4	377	30	449	34	826
1981	0	0	0	0	5	446	17	290	22	736
Lake Huron Shore										
1971	7	15 756	0	0	3	325	12	102	22	16 183
1976	6	14 845	0	0	3	351	15	130	24	15 326
1981	6	12 775	0	0	4	385	11	125	21	13 285
Lake Superior Shore										
1971	5	1 428	0	0	0	0	3	33	8	1 461
1976	3	1 217	0	0	0	0	0	0	3	1 217
1981	2	1 000-1 499	0	0	0	0	2	2-99	4	1 109
Hudson Bay and Ungava Bay Basin										
1971	45	14 167	.. ⁶	.. ⁶	26	2 489	24	361	..	..
1976	40	12 941	12	1 000-1 499	26	3 389	16	335	94	17 500-17 999
1981	37	13 206	11	500-999	27	4 203	15	199	90	18 000-18 499
Hudson Bay and Ungava Bay Coastal										
1971	31	8 403	0	0	2	100-199	0	0	33	8 500-8 999
1976	21	6 501	0	0	3	200-499	1	1-99	25	6 864
1981	24	8 245	0	0	3	155	0	0	27	8 400
Nelson River										
1971	1	2 500-2 999	0	0	1	1-99	0	0	2	2 500-2 999
1976	3	3 167	0	0	0	0	0	0	3	3 167
1981	2	2 500-2 999	0	0	0	0	1	1-99	3	2 506

Table 6.1.2
Mining Activity¹ by Major Drainage Area, 1971, 1976 and 1981² (continued)

Major Drainage Area	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵	Establishments ⁴	Workers ⁵
Lake Winnipeg Shore										
1971	11	1 977	0	0	3	89	8	150	22	2 216
1976	12	2 447	0	0	2	2-99	6	100-199	20	2 650
1981	9	1 932	0	0	3	193	6	65	18	2 190
Assiniboine River										
1971	0	0	3	164	7	1 030	6	37	16	1 231
1976	0	0	4	200-499	7	1 320	1	1-99	12	1 559
1981	0	0	5	200-499	7	1 786	1	1-99	13	2 122
Saskatchewan River										
1971	2	1 000-1 499	.. ⁶	.. ⁶	13	1 204	10	174	...	...
1976	4	826	8	874	14	1 642	8	177	34	3 519
1981	2	500-999	6	510	14	2 069	7	100-199	29	3 221
Arctic Ocean Basin										
1971	8	1 025	.. ⁶	.. ⁶	4	643	2	2-99	...	...
1976	10	1 000-1 499	2	1 000-499	5	500-999	0	0	17	3 049
1981	12	2 000-2 499	4	1 791	4	567	0	0	20	4 466
Mackenzie River										
1971	8	1 025	.. ⁶	.. ⁶	4	643	2	2-99	...	...
1976	9	1 271	2	1 000-1 499	5	500-999	0	0	16	3 002
1981	11	1 924	4	1 791	4	567	0	0	19	4 282
Arctic Ocean Coastal										
1971	0	0	0	0	0	0	0	0	0	0
1976	1	1-99	0	0	0	0	0	0	1	1-99
1981	1	100-199	0	0	0	0	0	0	1	100-199
Pacific Ocean Basin										
1971	31	5 818	1	1 000-1 499	11	200-499	23	200-499	66	7 744
1976	28	5 948	3	2 058	6	100-199	15	200-499	52	8 366
1981	31	7 885	3	2 767	5	100-199	9	200-499	48	10 990
Columbia River										
1971	13	1 781	1	1 000-1 499	2	2-99	2	2-99	18	3 185
1976	9	1 580	3	2 058	2	2-99	2	2-99	16	3 703
1981	9	2 534	3	2 767	2	2-99	2	2-99	16	5 394
Fraser River										
1971	6	1 445	0	0	9	234	16	208	31	1 887
1976	6	2 034	0	0	4	133	8	67	18	2 234
1981	10	2 544	0	0	3	80	3	63	16	2 687
Yukon River										
1971	3	606	0	0	0	0	0	0	3	606
1976	3	641	0	0	0	0	0	0	3	641
1981	3	838	0	0	0	0	0	0	3	838
Pacific Ocean, North Coastal										
1971	4	1 023	0	0	0	0	0	0	4	1 023
1976	5	657	0	0	0	0	0	0	5	657
1981	6	872	0	0	0	0	0	0	6	872
Pacific Ocean, South Coastal										
1971	5	963	0	0	0	0	5	80	10	1 043
1976	5	1 036	0	0	0	0	5	95	10	1 131
1981	3	1 097	0	0	0	0	4	102	7	1 199
Gulf of Mexico Basin										
1971	0	0	0	0	1	1-99	0	0	1	1-99
1976	0	0	0	0	1	1-99	0	0	1	1-99
1981	0	0	1	1-99	0	0	0	0	1	1-99
Missouri River										
1971	0	0	0	0	1	1-99	0	0	1	1-99
1976	0	0	0	0	1	1-99	0	0	1	1-99
1981	0	0	1	1-99	0	0	0	0	1	1-99
Canada										
1971	137	50 033	35	6 343	128	11 873	304	4 282	604	72 531
1976	117	49 834	28	7 777	117	12 035	265	4 412	527	74 058
1981	125	49 586	33	9 188	124	12 557	219	3 109	501	74 440

Table 6.1.2
Mining Activity¹ by Major Drainage Area, 1971, 1976 and 1981² (concluded)

Excludes crude petroleum and natural gas industry and services incidental to mining.

Ranges are used to meet the confidentiality restrictions of the Statistics Act. Includes asbestos, salt, potash, sulfur and miscellaneous non-metallic mineral mines.

The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics. Includes production and related workers, e.g. those of the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

⁶ It was not possible to allocate the 1971 coal mining data by drainage basins for Alberta. The unallocated figures for the province are 24 establishments and 1669 production workers. Coal mining is confined to the Mackenzie and Saskatchewan Drainage Areas. These figures are included in the totals.

Sources:

Energy, Mines and Resources Canada, Annual Census of Metal Mines Non-Metal Mines and Sand Pits and Quarries, 1971, 1976 and 1981.
Statistics Canada, Annual Census of Coal Mines, 1976 and 1981
Statistics Canada, *Coal Mines*, Catalogue 26-206, 1971.
Statistics Canada, Office of the Senior Adviser on Integration, special tabulations.

Table 6.1.3
Consumption of Fuel and Electricity¹ by Mining Industries², by Ecozone, 1976 and 1981

Ecozone	Fossil Fuel			Electricity			Total		
	1976	1981	Percent Change 1976 to 1981	1976	1981	Percent Change 1976 to 1981	1976	1981	Percent Change 1976 to 1981
	terajoules			terajoules			terajoules		
Atlantic Maritime	10 404	8 281	-20.4	2 582	4 069	57.6	12 986	12 350	-4.9
Nova Scotia	1 282	1 460	13.9	461	675	46.4	1 743	2 135	22.5
New Brunswick	1 526	1 942	27.3	1 078	1 416	31.4	2 604	3 358	29.0
Québec	7 596	4 878	-35.8	1 042	1 978	89.8	8 638	6 856	-20.6
Fixed-									
Wood Plain	12 249	10 545	-13.9	3 480	3 169	-8.9	15 729	13 714	-12.8
Québec	8 254	6 418	-22.2	2 664	2 517	-5.5	10 918	8 935	-18.2
Ontario	3 995	4 127	3.3	815	652	-20.0	4 810	4 779	-0.6
Boreal Shield	40 169	29 281	-27.1	23 077	18 999	-17.7	63 246	48 280	-23.7
Newfoundland	1 389	1 252	-9.9	438	364	-16.9	1 827	1 616	-11.5
Québec	11 855	11 508	-2.9	7 716	7 397	-4.1	19 571	18 905	-3.4
Ontario	25 272	15 191	-39.9	12 438	9 555	-23.2	37 710	24 746	-34.4
Manitoba	1 630	1 291	-20.8	2 306	1 594	-30.9	3 936	2 885	-26.7
Saskatchewan	23	39	69.6	179	89	-50.3	202	128	-36.6
Prairie	23 122	27 629	19.5	3 302	4 034	22.2	26 424	31 663	19.8
Manitoba	119	70	-41.2	9	7	-22.2	128	77	-39.8
Saskatchewan	22 212	26 888	21.1	3 212	3 912	21.8	25 424	30 800	21.1
Alberta	791	672	-15.0	81	115	42.0	872	787	-9.7
Boreal Plain	1 681	3 169	88.5	284	526	85.2	1 965	3 695	88.0
Manitoba	219	186	-15.1	170	215	26.5	389	401	3.1
Saskatchewan	515	996	93.4	2	5	150.0	517	1 001	93.6
Alberta	947	1 987	109.8	112	305	172.3	1 059	2 292	116.4
Montane									
Cordillera	9 448	14 374	52.1	6 528	9 263	41.9	15 976	23 637	48.0
Alberta	2 298	1 338	-41.8	632	307	-51.4	2 930	1 645	-43.9
British Columbia	7 149	13 036	82.3	5 897	8 957	51.9	13 046	21 993	68.6
Pacific Maritime	3 330	3 301	-0.9	1 677	1 852	10.4	5 007	5 153	2.9
British Columbia	3 330	3 301	-0.9	1 677	1 852	10.4	5 007	5 153	2.9
Boreal Cordillera	2 524	1 842	-27.0	728	586	-19.5	3 252	2 428	-25.3
British Columbia	1 490	1 326	-11.0	0	0	...	1 490	1 326	-11.0
Yukon	1 034	515	-50.2	728	586	-19.5	1 762	1 101	-37.5
Arctic Cordillera	0	391	...	0	0	...	0	391	...
Northwest Territories	0	391	...	0	0	...	0	391	...
Taiga Plain	838	764	-8.8	405	377	-6.9	1 243	1 141	-8.2
Northwest Territories	838	764	-8.8	405	377	-6.9	1 243	1 141	-8.2
Taiga Shield	21 557	18 794	-12.8	7 626	4 981	-34.7	29 183	23 775	-18.5
Newfoundland	19 002	17 162	-9.7	7 351	4 836	-34.2	26 353	21 998	-16.5
Québec	1 620	516	-68.1	137	9	-93.4	1 757	525	-70.1
Saskatchewan	0	560	...	0	7	...	0	567	...
Northwest Territories	935	556	-40.5	138	130	-5.8	1 073	686	-36.1

Table 6.1.3
Consumption of Fuel and Electricity¹ by Mining Industries², by Ecozone, 1976 and 1981 (concluded)

Ecozone	Fossil Fuel			Electricity			Total		
	1976	1981	Percent Change 1976 to 1981	1976	1981	Percent Change 1976 to 1981	1976	1981	Percent Change 1976 to 1981
	terajoules			terajoules			terajoules		
Northern Arctic	100	335	235.0	0	0	---	100	335	235.0
Northwest Territories	100	335	235.0	0	0	---	100	335	235.0
Canada	125 420	118 705	-5.4	49 688	47 855	-3.7	175 108	166 560	-4.9

¹ Data include purchased fuel and electricity and exclude any self produced fuel and electricity, fuel used for non-fuel purposes (production processes), and other energy sources such as steam or wood. Figures apply only to larger establishments reporting detail in their mining and non-mining (e.g. transportation, space heating) operations.

² Includes metal mines, coal mines, non-metal mines and sand pits and quarries.

Sources:

Energy, Mines and Resources Canada, Annual Census of Metal Mines, Non-Metal Mines and Sand Pits and Quarries, 1976 and 1981.
Statistics Canada, Annual Census of Coal Mines, 1976 and 1981.
Statistics Canada, Office of the Senior Adviser on Integration, special tabulations.

Note:

Individual items may not add to totals due to rounding.

Table 6.1.4
Consumption of Fuel and Electricity¹ by Mining Industries², by Major Drainage Area, 1976 and 1981

Major Drainage Area	Fossil Fuel			Electricity			Total		
	1976	1981	Percent Change 1976 to 1981	1976	1981	Percent Change 1976 to 1981	1976	1981	Percent Change 1976 to 1981
	terajoules			terajoules			terajoules		
Atlantic Ocean Basin	65 905	57 939	-12.1	28 147	23 732	-15.7	94 051	81 671	-13.2
Atlantic Ocean Coastal	20 717	18 327	-11.5	7 833	5 069	-35.3	28 550	23 396	-18.1
Gulf of St.Lawrence Coastal	20 551	10 812	-47.4	8 114	7 395	-8.9	28 664	18 207	-36.5
Bay of Fundy Coastal and Saint John River	378	851	124.9	158	294	85.7	537	1 145	113.3
St.Lawrence River	7 473	12 947	73.2	2 446	4 347	77.7	9 919	17 294	74.4
Ottawa River	2 262	2 683	18.6	1 661	1 564	-5.8	3 923	4 247	8.3
Lake Ontario Shore	2 102	1 158	-44.9	494	332	-32.8	2 596	1 490	-42.6
Lake Erie and Lake St.Clair Shore	1 196	1 104	-7.7	215	223	3.7	1 411	1 327	-5.9
Lake Huron Shore	7 086	6 565	-7.4	6 419	3 783	-41.1	13 504	10 348	-23.4
Lake Superior Shore	4 140	3 492	-15.6	807	725	-10.2	4 947	4 217	-14.7
Hudson Bay and Ungava Bay Basin	42 187	37 238	-11.7	12 310	11 601	-5.8	54 496	48 837	-10.4
Hudson Bay and Ungava Bay Coastal	4 413	4 832	9.5	3 803	4 032	6.0	8 216	8 864	7.9
Nelson River	1 001	792	-20.9	1 753	1 091	-37.8	2 754	1 882	-31.7
Lake Winnipeg Shore	12 244	3 262	-73.4	2 992	2 144	-28.4	15 235	5 405	-64.5
Assiniboine River	14 447	18 391	27.3	1 540	1 808	17.4	15 987	20 199	26.3
Saskatchewan River	10 082	9 961	-1.2	2 222	2 526	3.7	12 304	12 487	1.5
Arctic Ocean Basin	6 266	6 666	6.4	1 166	1 084	-7.0	7 431	7 750	4.3
Mackenzie River	6 166	6 331	2.7	1 166	1 084	-7.0	7 331	7 415	1.1
Arctic Ocean Coastal	100	335	236.6	0	0	---	100	335	236.6
Pacific Ocean Basin	10 870	16 851	55.0	8 064	11 395	41.3	18 933	28 248	49.2
Columbia River	4 969	9 857	98.4	2 500	4 869	94.8	7 468	14 726	97.2
Fraser River	2 262	3 026	33.8	2 931	3 665	25.0	5 193	6 692	28.9
Yukon River	390	515	32.0	728	586	-19.5	1 118	1 102	-1.5
Pacific Ocean, North Coastal	2 189	2 040	-6.8	495	484	-2.3	2 684	2 524	-6.0
Pacific Ocean, South Coastal	1 060	1 413	33.3	1 410	1 791	27.0	2 470	3 204	29.7
Gulf of Mexico Basin	196	12	-93.7	3	43	1 439.3	199	55	-72.1
Missouri River	196	12	-93.7	3	43	1 439.3	199	55	-72.1
Canada	125 420	118 705	-5.4	49 688	47 855	-3.7	175 108	166 560	-4.9

¹ Data include purchased fuel and electricity and exclude any self produced fuel and electricity, fuel used for non fuel purposes (production processes), and other energy sources such as steam or wood. Figures apply only to larger establishments reporting detail in their mining and non-mining (e.g. transportation, space heating) operations.

² Includes metal mines, coal mines, non-metal mines and sand pits and quarries.

Sources:

Energy, Mines and Resources Canada, Annual Census of Metal Mines, Non-Metal Mines and Sand Pits and Quarries, 1976 and 1981.
Statistics Canada, Annual Census of Coal Mines, 1976 and 1981.
Statistics Canada, Office of the Senior Adviser on Integration, special tabulations.

Note:

Individual items may not add to totals due to rounding.

Table 6.1.5
Metal Mining Waste Generation by Ecozone, 1981¹

Ecozone	Open Pit			Underground			Total Rock Waste ²	Tailings and Residues ³	
	Rock Waste ⁴	Ore	Proportion of Waste to Ore ⁵	Rock Waste ⁴	Ore	Proportion of Waste to Ore ⁵		Total	Amount Used in Backfill
	thousands of tonnes			thousands of tonnes			thousands of tonnes	thousands of tonnes	
Atlantic Maritime	1 200-2 600	5 000-10 100	0.2	100-400	3 500-7 000	--	1 300-3 000	7 700-15 500	0-300
Nova Scotia	0	0	...	100-200	500-1 000	0.2	100-200	200-500	0-100
New Brunswick	0-100	0-100	--	0-100	2 500-5 000	--	0-200	2 500-5 000	0-100
Québec	1 200-2 500	5 000-10 000	0.2	0-100	500-1 000	--	1 200-2 600	5 000-10 000	0-100
Great Shield	58 700-70 300	56 000-66 500	1.0	3 600-5 100	38 500-52 000	0.1	62 300-75 400	73 200-86 500	4 500-8 700
Newfoundland	0	0	...	0-100	500-1 000	0.1	0-100	500-1 000	0-100
Québec	39 300-44 300	40 000-45 000	1.0	800-1 500	5 000-10 000	0.2	40 100-45 800	35 000-40 000	1 500-2 500
Ontario	19 300-25 800	15 000-20 000	1.3	2 500-2 900	30 000-35 000	0.1	21 800-28 700	35 000-40 000	2 500-5 000
Manitoba	100-200	1 000-1 500	0.1	300-500	2 500-5 000	0.1	400-700	2 500-5 000	500-1 000
Saskatchewan	0	0	...	0-100	500-1 000	0.1	0-100	200-500	0-100
Great Plain	1 600-3 200	500-1 000	3.2	0-100	500-1 000	--	1 600-3 300	1 000-2 000	200-600
Manitoba	0	0	...	0-100	500-1 000	--	0-100	500-1 000	200-500
Saskatchewan	1 600-3 200	500-1 000	3.2	0	0	...	1 600-3 200	500-1 000	0-100
Montane Cordillera	171 732	92 954	1.8	249	3 809	0.1	171 981	91 034	26
British Columbia	171 732	92 954	1.8	249	3 809	0.1	171 981	91 034	26
Pacific Maritime	37 999	14 087	2.7	273	1 957	0.1	38 272	15 266	125
British Columbia	37 999	14 087	2.7	273	1 957	0.1	38 272	15 266	125
Great Cordillera	30 938	2 511	12.3	17	822	--	30 955	3 003	7
British Columbia	0	0	...	4	57	0.1	4	57	0
Yukon	30 938	2 511	12.3	13	765	--	30 951	2 946	7
Arctic Cordillera	0	0	...	0-100	200-500	--	0-100	200-500	0-100
Northwest Territories	0	0	...	0-100	200-500	--	0-100	200-500	0-100
Great Plain	10 000-20 000	2 500-5 000	4.0	0	0	...	10 000-20 000	2 500-5 000	0-100
Northwest Territories	10 000-20 000	2 500-5 000	4.0	0	0	...	10 000-20 000	2 500-5 000	0-100
Great Shield	18 000-20 000	60 100-65 400	0.3	200-600	700-1 500	0.4	18 200-20 600	30 700-36 600	100-500
Newfoundland	17 800-18 400	60 000-65 000	0.3	0	0	...	17 800-18 400	30 000-35 000	0-100
Québec	0-800	0-100	8.1	0	0	...	0-800	0-100	0-100
Saskatchewan	0-400	0-100	3.6	100-400	200-500	0.7	100-800	200-500	100-200
Northwest Territories	200-400	100-200	1.8	100-200	500-1 000	0.2	300-600	500-1 000	0-100
Northern Arctic	0	0	...	100-200	500-1 000	0.2	100-200	200-500	0-100
Northwest Territories	0	0	...	100-200	500-1 000	0.2	100-200	200-500	0-100
Canada	338 780	243 108	1.4	5 448	58 423	0.1	344 228	235 684	6 528

¹ Ranges are used to meet the confidentiality restrictions of the Statistics Act.

² Rock waste produced by mining operations before processing.

³ Tailings and residues are wastes generated in the processing of ores.

⁴ Rock waste include overburden.

⁵ Amount of rock waste produced per tonne of ore produced.

Source:

Energy, Mines and Resources Canada, Annual Census of Metal Mines, 1981.
Statistics Canada, Office of the Senior Adviser on Integration, Special tabulation.

Table 6.1.6
Coal Mining Rock Waste Generation by Ecozone, 1981¹

Ecozone	Surface			Underground		
	Rock Waste ²	Coal Extracted	Proportion of Rock Waste to Coal Extracted ³	Rock Waste	Coal Extracted	Proportion of Rock Waste to Coal Extracted ³
	thousands of tonnes			thousands of tonnes		
Atlantic Maritime	2 700-6 800	700-1 500	4.8	400-580	1 500-2 500	0.3
Nova Scotia	2 700-6 700	200-500	13.5	400-580	1 500-2 500	0.3
New Brunswick	0-100	500-1 000	--	0	0	...
Prairie	54 343	9 599	5.7	0	0	...
Saskatchewan	40 031	7 363	5.4	0	0	...
Alberta	14 312	2 236	6.4	0	0	...
Boreal Plain	49 139	14 934	3.3	0	0	...
Alberta	49 139	14 934	3.3	0	0	...
Montane Cordillera	75 700-116 500	11 500-17 500	6.4	0-200	2 000-3 000	...
Alberta	17 700-29 500	1 500-2 500	11.8	0-100	1 000-1 500	...
British Columbia	58 000-87 000	10 000-15 000	5.8	0-100	1 000-1 500	...
Canada	209 034	41 151	5.1	580	4 489	0.1

¹ Ranges are used to meet the confidentiality restrictions of the Statistics Act.

² Rock waste includes overburden.

³ Amount of rock waste produced per tonne of coal extracted.

Source:

Statistics Canada, Annual Census of Coal Mines, 1981, special tabulation by the Office of the Senior Adviser on Integration.

6.2

Manufacturing

Stressor Type:

a Classification of Industrial Stress

This three-way classification of the Standard Industrial Classification by stressor type was developed in response to the need for spatial analysis of environmental stress. The group classes are underpinned by the relationship between industrial processes and the generation of waste residuals. The stress impact of individual establishments varies with the scale of operation, the type of industrial process employed, and the effectiveness of pollution abatement equipment. Moreover, the relationship between plant location and neighbouring human activities, ecological characteristics of the surrounding area and meteorological conditions must also be taken into account for any environmental impact assessment. The data displayed here (Section 6.2) should be considered as a first approximation of potential stress of industrial activity in geographic space.

The **high stressor group** is identified with what are sometimes referred to as heavy industries which include pulp and paper, metal smelting and refining, industrial chemicals, mining and thermal power generation. These industries are associated with large-scale activities of extraction, concentration, refining, and energy conversion. These are characterized as processes which draw raw materials from the environment and transform them into early stage products in the industrial chain. Typically, they exhibit high energy consumption per unit of output, generate high levels of waste residuals and are frequently associated with large-scale landscape change. Not surprisingly, a large part of the expenditure on industrial pollution abatement equipment is concentrated in these industries; they account for approximately eighty percent of expenditures on water treatment and seventy-five percent of expenditures on air pollution abatement (see Table 8.1.2). In manufacturing, the high stressor type industries accounted for only 1.2 percent of manufacturing establishments in 1981, yet consumed sixty percent of the energy¹, contributed twenty percent of the value added, and employed twelve percent of the production workers (see Table 6.2.2).



¹ The figure here is based on purchased electricity and fuels - some of these industries also produce energy for their own needs. See Technical Box 6.6.1, Energy Intensity of Industrial Processes: an Indicator of Environmental Stress

The **medium stressor group** is composed of industries associated with further processing of materials into specialized products required for the next and final stage of manufacturing although some finished manufacturing goods are included because of special pollution concerns (e.g. food processing, pharmaceuticals). In these industries, unlike those of the high stressor category, stresses tended to be more specific to either air or water. For this reason it was considered useful to further classify them by media. The criteria delineating medium stressor industries are not as clear-cut as those for the high stressor category. First, there is a greater range of variability between individual establishments with respect to scale of operation, process employed, and product produced. Second, the distinction between the low and medium stress levels is subject to some degree of arbitrariness. The list was ultimately drawn-up after discussions with experts who were knowledgeable regarding the pollution characteristics of particular industries, and by taking into account industries identified for development of pollution control guidelines by the Environmental Protection

Service of Environment Canada. This group must be considered as preliminary until better data become available on actual emission measures. About thirty percent of all manufacturing establishments fall into this category for water and thirteen percent for air.

The **low stressor group** contains the remaining industries and in this sense can be considered as a residual category. Nevertheless, it accounts for a large proportion of the industries which produce final goods. They tend to fall under the process headings of assembly, construction, or packaging and are generally characterized by high labour input per unit of output, with relatively low energy and raw material inputs. According to 1981 data, the low stressor to water group accounted for sixty-nine percent of the establishments, employed sixty-one percent of the production workers and consumed eighteen percent of the energy. Low stressor to air accounted for eighty-six percent of establishments, seventy-eight percent of the production workers, and twenty-six percent of the energy consumed.

Industries by Stressor Type — Industries Defined by the Standard Industrial Classification¹ (continued)

High Stressor (Pollutants to Air and Water)

Metal mines	051-059
Coal mines	061
Crude petroleum and natural gas industry	064
Non-metal mines	071-079
Pulp and paper mills	271
Iron and steel mills	291
Smelting and refining	295
Petroleum refining	3651
Manufacturers of industrial chemicals	378
Electric power (Thermal and nuclear)	572

Medium Stressor (Pollutants to Air)

Quarries and sand pits	083-087
Bakery products	107
Sawmills, planing and shingle mills	251
Veneer and plywood mills	252
Foundries	294
Manufacturers of miscellaneous electrical products	339
Plastic products manufacturers	351
Cement manufacturers	352
Stone products manufacturers	353
Concrete products manufacturers	354
Glass and glass products manufacturers	356
Abrasive manufacturers	357
Rubber manufacturers	358
Miscellaneous non-metallic mineral products	359
Miscellaneous petroleum and coal products	369
Manufacturers of mixed fertilizers	372
Manufacturers of plastics and synthetic resins	373

Medium Stressor (Pollutants to Water)

Logging	031
Quarries and sand pits	083-087
Meat and poultry products	101
Fish products	102
Fruit and vegetable processing	103
Dairy	104
Flour and breakfast cereal products	105
Food industry	106
Beverage industry	109
Rubber and tube manufacturers	1623
Leather tanneries	172
Textile industries	181-189
Asphalt roofing manufacturers	272
Steel pipe and tube mills	292
Foundries	294
Aluminum rolling, casting and extruding	296
Copper and copper alloy rolling, casting and extruding	297
Aluminum rolling, casting and extruding, n.e.s.	298
Metal fabricating	301-309
Plastic products manufacturers	351
Cement manufacturers	352
Ready-mix concrete manufacturers	355
Rubber manufacturers	358
Manufacturers of lubricating oils and greases	3652
Miscellaneous petroleum and coal products	369
Manufacturers of mixed fertilizers	372
Manufacturers of synthetic plastics and resins	373
Manufacturers of pharmaceuticals and medicines	374

Paint and varnish	375
Soap and cleaning compounds	376
Miscellaneous chemicals	379

Low Stressor (Pollutants to Air)

Logging	031
Food and beverage industries	101-109, except 107
Tobacco products	151 and 153
Rubber and plastics products	162-165
Leather industries	172-179
Textile industries	181-189
Knitting mills	231 and 239
Clothing industries	243-249
Wood industries	254-259
Furniture and fixtures	261-268
Asphalt roofing manufacturers	272
Paper box and bag manufacturers	273
Miscellaneous paper converters	274
Printing, publishing and allied	286-289
Steel pipe and tube mills	292
Aluminum rolling, casting and extruding	296
Copper and copper alloy rolling, casting and extruding	297
Metal fabricating	301-309
Machinery	311-318
Transportation equipment	321-329
Electrical products	331-339
Ready-mix concrete manufacturers	355
Manufacturers of lubricating oils and greases	3652
Manufacturers of pharmaceuticals and medicines	374
Paint and varnish	375
Soap and cleaning compounds	376
Manufacturers of toilet preparations	377
Miscellaneous chemicals	379
Miscellaneous manufacturing	391-399

Low Stressor (Pollutants to Water)

Bakery products	107
Miscellaneous food industries	108
Tobacco products	151 and 153
Rubber footwear	1624
Miscellaneous rubber products	1629
Plastic fabricating, n.e.s.	165
Shoe factories	174
Leather glove factories	175
Luggage, handbag and small leather goods	179
Knitting mills	231 and 239
Clothing industries	243-249
Wood industries	251-259
Furniture and fixtures	261-268
Paper box and bag manufacturers	273
Miscellaneous paper converters	274
Printing, publishing and allied	286-289
Machinery	311-318
Transportation equipment	321-329
Electrical products	331-339
Stone products	353
Concrete products	354
Glass and glass products	356
Abrasive manufacturers	357
Miscellaneous non-metallic mineral products	359
Manufacturers of toilet preparations	377
Miscellaneous manufacturing	391-399

¹Includes primary industries (excluding agriculture), manufacturing industries and the electric power generation industry.

Table 6.2.1
Manufacturing Activity¹ by Stressor Type: Stress to Air, 1971, 1976 and 1981

Stressor Type	Establishments ²		Workers ³		Value Added ⁴		Purchased Energy			
							Fossil Fuels		Electricity	
	number	percent	number	percent	millions of constant 1971 dollars	percent	terajoules	percent	terajoules	percent
High:										
1971	404	1.3	143 934	12.3	3 601	15.5				
1976	403	1.4	149 762	11.7	4 624	17.5	532 316	56.1	182 492	66.6
1981	420	1.2	156 499	11.7	6 130	19.8	567 849	57.7	221 566	66.3
Medium:										
1971	5 049	15.8	135 492	11.6	2 295	9.9				
1976	4 130	14.2	140 223	11.0	2 775	10.5	153 134	16.1	29 121	10.6
1981	4 485	12.5	142 435	10.7	2 717	8.8	148 671	15.1	35 825	10.7
Low:										
1971	26 455	82.9	888 384	76.1	17 292	74.6				
1976	24 520	84.4	986 708	77.3	19 065	72.0	263 895	27.8	62 502	22.8
1981	30 875	86.3	1 038 395	77.6	22 140	71.4	267 777	27.2	76 692	23.0
Total:										
1971	31 908	100.0	1 167 810	100.0	23 188	100.0				
1976	29 053	100.0	1 276 693	100.0	26 464	100.0	949 344	100.0	274 115	100.0
1981	35 780	100.0	1 337 329	100.0	30 987	100.0	984 296	100.0	334 083	100.0

¹ Standard Industrial Classification Codes, 101 to 399.

² The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

³ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

⁴ Constant values are obtained by using the gross domestic product deflator for manufacturing industries.

Sources:

Statistics Canada, Annual Census of Manufactures, 1976 and 1981.
 Statistics Canada, *General Review of the Manufacturing Industries of Canada*, Catalogue 31-203, 1971.
 Statistics Canada, *Gross Domestic Product by Industry*, Catalogue 61-213.
 Statistics Canada, Office of the Senior Adviser on Integration, special tabulations.

Table 6.2.2
Manufacturing Activity¹ by Stressor Type: Stress to Water, 1971, 1976 and 1981

Stressor Type	Establishments ²		Workers ³		Value Added ⁴		Purchased Energy			
							Fossil Fuels		Electricity	
	number	percent	number	percent	millions of constant 1971 dollars	percent	terajoules	percent	terajoules	percent
High:										
1971	404	1.3	143 934	12.3	3 601	15.5				
1976	403	1.4	149 762	11.7	4 624	17.5	532 316	56.1	182 492	66.6
1981	420	1.2	156 499	11.7	6 130	19.8	567 849	57.7	221 566	66.3
Medium:										
1971	10 223	32.0	325 801	27.9	7 067	30.5				
1976	9 189	31.6	356 320	27.9	7 856	29.7	241 792	25.5	40 598	14.8
1981	10 786	30.1	370 208	27.7	8 831	28.5	237 106	24.1	49 408	14.8
Low:										
1971	21 281	66.7	698 075	59.8	12 520	54.0				
1976	19 461	67.0	770 611	60.4	13 984	52.8	175 236	18.4	51 025	18.6
1981	24 574	68.7	810 622	60.6	16 026	51.7	179 341	18.2	63 109	18.9
Total:										
1971	31 908	100.0	1 167 810	100.0	23 188	100.0				
1976	29 053	100.0	1 276 693	100.0	26 464	100.0	949 844	100.0	274 115	100.0
1981	35 780	100.0	1 337 329	100.0	30 987	100.0	984 296	100.0	334 083	100.0

¹ Standard Industrial Classification Codes, 101 to 399.

² The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

³ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

⁴ Constant values are obtained by using the gross domestic product deflator for manufacturing industries.

Sources:

Statistics Canada, Annual Census of Manufactures, 1976 and 1981.
 Statistics Canada, *General Review of the Manufacturing Industries of Canada*, Catalogue 31-203, 1971.
 Statistics Canada, *Gross Domestic Product by Industry*, Catalogue 61-213.
 Statistics Canada, Office of the Senior Adviser on Integration, special tabulations.

Table 6.2.3
Manufacturing Activity by Ecozone, 1981¹

Ecozone	High Stressor Manufacturing Activity					Total Manufacturing Activity		
	Establishments ²	Workers ³	Percent of Total Manufacturing Workers	Energy Consumption ⁴ terajoules	Percent of Total Manufacturing Energy Consumption	Establishments ²	Workers ³	Energy Consumption ⁴ terajoules
Atlantic Maritime	38	14 408	21.5	76 401	77.0	2 048	66 987	99 279
Prince Edward Island	0	0	0.0	0	0.0	150	2 382	716
Nova Scotia	13	4 498	15.7	15 321	60.2	814	28 590	25 440
New Brunswick	17	5 803	23.8	31 422	76.2	623	24 355	41 242
Québec	8	4 107	35.2	29 658	93.0	461	11 660	31 881
Mixed-Wood Plain	207	70 458	7.4	325 781	47.2	23 508	947 246	690 888
Québec	101	28 619	8.3	152 545	55.8	9 688	346 329	273 551
Ontario	106	41 839	7.0	173 236	41.5	13 820	600 917	417 335
Boreal Shield	61	43 295	49.5	181 442	89.6	1 835	87 403	202 404
Newfoundland	6	2 923	19.4	13 446	76.7	313	15 034	17 542
New Brunswick	0	0	0.0	0	0.0	3	59	0-99
Québec	18	12 986	45.2	56 447	89.8	766	28 708	62 829
Ontario	34	26 218	62.0	103 904	90.7	733	42 292	114 550
Manitoba	2	500-999	87.9	4 000-4 499	99.6	19	1 000-1 499	4 000-4 499
Saskatchewan	1	200-499	95.5	2 500-2 999	99.9	2	2 000-2 499	2 500-2 999
Prairie	44	5 347	5.0	102 790	63.4	4 079	106 758	162 218
Manitoba	7	328	0.9	3 914	18.3	1 187	38 756	21 348
Saskatchewan	7	294	2.3	1 951	16.9	673	12 959	11 546
Alberta	30	4 725	8.6	96 925	74.9	2 219	55 043	129 324
Boreal Plain	10	2 770	25.8	14 833	55.8	425	10 722	26 580
Manitoba	5	1 352	57.5	6 153	82.2	81	2 352	7 482
Saskatchewan	1	200-499	17.7	3 000-3 499	58.1	88	2 000-2 499	5 500-5 999
Alberta	3	890	18.5	4 636	38.9	209	4 819	11 908
British Columbia	1	100-199	10.8	500-999	50.7	45	1 000-1 499	1 500-1 999
Yukon	0	0	0.0	0	0.0	2	2-99	0-99
Montane Cordillera	17	6 711	20.8	27 715	54.8	905	32 234	50 545
Alberta	0	0	0.0	0	0.0	24	533	4 872
British Columbia	17	6 711	21.2	27 715	60.7	881	31 701	45 673
Pacific Maritime	40	13 487	15.7	60 064	69.8	2 947	85 660	86 029
British Columbia	40	13 487	15.7	60 064	69.8	2 947	85 660	86 029
Boreal Cordillera	2	2-99	4.9	0-99	30.0	7	7-99	0-99
Yukon	2	2-99	4.9	0-99	30.0	7	7-99	0-99
Taiga Plain	1	1-99	16.4	200-499	96.2	8	100-199	200-499
Northwest Territories	1	1-99	16.4	200-499	96.2	8	100-199	200-499
Taiga Shield	0	0	0.0	0	0.0	12	111	17
Newfoundland	0	0	0.0	0	0.0	4	4-99	0-99
Saskatchewan	0	0	0.0	0	...	1	1-99	0
Northwest Territories	0	0	0.0	0	0.0	7	66	0-99
Hudson Bay Plain	0	0	0.0	0	0.0	1	1-99	0-99
Manitoba	0	0	0.0	0	0.0	1	1-99	0-99
Southern Arctic	0	0	0.0	0	0.0	2	2-99	0-99
Northwest Territories	0	0	0.0	0	0.0	2	2-99	0-99
Northern Arctic	0	0	0.0	0	...	3	27	0
Northwest Territories	0	0	0.0	0	...	3	27	0
Canada	420	156 499	11.7	789 415	59.9	35 780	1 337 329	1 318 379

¹ Ranges are used to meet the confidentiality restrictions of the Statistics Act.

² The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

³ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

⁴ Data include purchased fuel and electricity and exclude any self produced fuel and electricity, fuel used for non-fuel purposes (production processes), and other energy sources such as steam or wood. Figures apply only to larger establishments reporting detail in their manufacturing and non-manufacturing (e.g. transportation, space heating) operations.

Source:

Statistics Canada, Annual Census of Manufactures, 1981, special tabulation by the Office of the Senior Adviser on Integration.

Table 6.2.4
Manufacturing Activity by Stressor Type: Stress to Water, by Major Drainage Area, 1973¹, 1976 and 1981²

Major Drainage Area	High Stressor		Medium Stressor		Low Stressor		Total	
	Establishments ³	Workers ⁴	Establishments ³	Workers ⁴	Establishments ³	Workers ⁴	Establishments ³	Workers ⁴
Atlantic Ocean Basin								
1973	277	113 453	7 510	297 565	16 057	650 555	23 844	1 061 573
1976	275	116 513	7 138	298 896	14 831	639 973	22 244	1 055 382
1981	292	20 450	8 245	304 590	18 607	661 363	27 144	1 086 403
Atlantic Ocean Coastal								
1973	9	2 142	178	7 802	342	6 320	529	16 264
1976	9	2 217	178	8 554	281	5 926	468	16 697
1981	8	2 120	243	11 381	378	6 241	629	19 742
Gulf of St. Lawrence Coastal								
1973	28	12 344	339	12 028	492	8 486	859	32 858
1976	29	12 193	302	11 318	410	7 240	741	30 751
1981	25	11 715	351	15 475	554	8 507	930	35 697
Bay of Fundy and Saint John River								
1973	10	2 556	215	7 623	461	14 110	686	24 289
1976	10	2 683	196	7 618	413	14 189	619	24 490
1981	10	2 988	232	8 350	493	13 636	735	24 974
St. Lawrence River								
1973	106	32 890	2 525	103 273	6 730	242 849	9 361	379 012
1976	106	34 403	2 340	102 839	6 096	235 839	8 542	373 081
1981	118	37 842	2 631	101 532	7 532	233 361	10 281	372 735
Ottawa River								
1973	17	6 716	309	8 521	722	21 773	1 048	37 010
1976	18	7 433	284	7 890	646	21 545	948	36 868
1981	19	7 166	308	8 078	841	23 432	1 168	38 676
Lake Ontario Shore								
1973	59	32 230	2 497	98 594	5 073	230 674	7 629	361 498
1976	56	30 770	2 438	100 108	4 913	233 098	7 407	363 976
1981	59	29 973	2 894	99 284	6 221	254 565	9 174	383 822
Lake Erie and Lake St. Clair Shore								
1973	23	5 306	1 055	48 640	1 480	101 885	2 558	155 831
1976	24	5 694	1 023	49 288	1 404	98 973	2 451	153 955
1981	27	7 747	1 183	48 495	1 739	96 002	2 949	152 244
Lake Huron Shore								
1973	16	14 588	358	10 596	678	21 701	1 052	46 885
1976	15	16 329	346	10 774	592	20 373	953	47 476
1981	17	15 794	375	11 658	761	22 218	1 153	49 670
Lake Superior Shore								
1973	9	4 681	34	488	79	2 757	122	7 926
1976	8	4 791	31	507	76	2 790	115	8 088
1981	9	5 105	28	337	88	3 401	125	8 843
Hudson Bay and Ungava Bay Basin								
1973	69	12 500-12 999	277	32 000-32 499	2 521	55 500-55 999	3 867	100 000-100 499
1976	67	13 000-13 499	1 207	36 500-36 999	2 371	61 000-61 499	3 645	111 500-111 999
1981	66	15 000-15 499	1 484	40 500-40 999	3 033	72 000-72 499	4 583	128 000-128 499
Hudson Bay and Ungava Bay Coastal								
1973	8	3 394	55	367	132	5 179	195	8 940
1976	8	3 501	46	401	114	5 646	168	9 548
1981	7	4 062	51	424	145	6 477	203	10 963
Nelson River								
1973	2	500 - 999	3	3 - 99	2	2 - 99	7	500 - 999
1976	2	500 - 999	3	3 - 99	3	3 - 99	8	500 - 999
1981	1	500 - 999	3	3 - 99	5	5 - 99	9	500 - 999
Lake Winnipeg Shore								
1973	13	3 484	350	10 039	859	25 849	1 222	39 372
1976	13	4 198	330	10 739	759	26 092	1 102	41 029
1981	14	4 058	352	10 320	845	28 314	1 211	42 692
Assiniboine River								
1973	8	451	67	3 832	280	3 398	455	7 681
1976	7	330	153	4 246	253	4 116	413	8 692
1981	6	319	180	4 687	312	4 368	498	9 374

Table 6.2.4
Manufacturing Activity by Stressor Type: Stress to Water, by Major Drainage Areas, 1973¹, 1976 and 1981² (concluded)

Major Drainage Area	High Stressor		Medium Stressor		Low Stressor		Total	
	Establishments ³	Workers ⁴	Establishments ³	Workers ⁴	Establishments ³	Workers ⁴	Establishments ³	Workers ⁴
Saskatchewan River								
1973	38	4 434	702	17 798	1 248	21 221	1 988	43 453
1976	37	4 675	675	21 412	1 242	25 582	1 954	51 669
1981	38	6 239	898	25 412	1 726	32 922	2 662	64 573
Arctic Ocean Basin								
1973	4	508	41	200 - 499	133	3 000 - 3 499	178	4 000 - 4 499
1976	4	992	48	500 - 999	117	2 500 - 2 999	169	4 000 - 4 499
1981	4	793	68	500 - 999	145	4 000 - 4 499	217	5 500 - 5 999
MacKenzie River								
1973	4	508	41	339	131	3 187	176	4 034
1976	4	992	47	541	115	2 867	166	4 400
1981	4	793	67	703	142	4 131	213	5 627
Arctic Ocean Coastal								
1973	0	0	0	0	2	2 - 99	2	2 - 99
1976	0	0	1	1 - 99	2	2 - 99	3	3 - 99
1981	0	0	1	1 - 99	3	3 - 99	4	4 - 99
Pacific Ocean Basin								
1973	57	18 000-18 499	862	21 500-21 999	2 335	70 000-70 499	3 254	110 000-110 499
1976	57	18 500-18 999	795	20 000-20 499	2 140	66 000-66 499	2 992	105 000-105 499
1981	58	19 500-19 999	988	24 000-24 499	2 785	72 500-72 999	3 831	116 500-116 999
Columbia River								
1973	5	3 328	84	1 253	272	8 170	361	12 751
1976	5	3 257	88	1 325	258	7 295	351	11 877
1981	5	4 131	119	1 831	348	7 903	472	13 865
Fraser River								
1973	29	3 578	609	16 777	1 586	47 250	2 224	67 605
1976	28	3 986	557	15 248	1 446	45 413	2 031	64 647
1981	29	4 186	643	16 980	1 764	49 236	2 436	70 402
Yukon River								
1973	1	1 - 99	0	0	4	4 - 99	5	5 - 99
1976	1	1 - 99	1	1 - 99	3	3 - 99	5	5 - 99
1981	2	2 - 99	1	1 - 99	3	3 - 99	6	6 - 99
Pacific Ocean, North Coastal								
1973	5	3 449	24	1 354	42	1 861	71	6 664
1976	5	3 454	22	1 135	38	1 109	65	5 698
1981	4	3 054	27	1 594	48	1 451	79	6 099
Pacific Ocean, South Coastal								
1973	17	7 912	145	2 203	431	12 928	593	23 043
1976	18	8 152	127	2 345	395	12 425	540	22 922
1981	18	8 617	198	3 625	622	14 214	838	26 456
Gulf of Mexico Basin								
1973	0	0	0	0	2	2 - 99	2	2 - 99
1976	0	0	1	1 - 99	2	2 - 99	3	3 - 99
1981	0	0	1	1 - 99	4	100 - 199	5	100 - 199
Missouri River								
1973	0	0	0	0	2	2 - 99	2	2 - 99
1976	0	0	1	1 - 99	2	2 - 99	3	3 - 99
1981	0	0	1	1 - 99	4	100 - 199	5	100 - 199
Canada								
1973	407	144 780	9 690	351 542	21 048	779 663	31 145	1 275 985
1976	403	149 762	9 189	356 320	19 461	770 611	29 053	1 276 693
1981	420	156 499	10 786	370 208	24 574	810 622	35 780	1 337 329

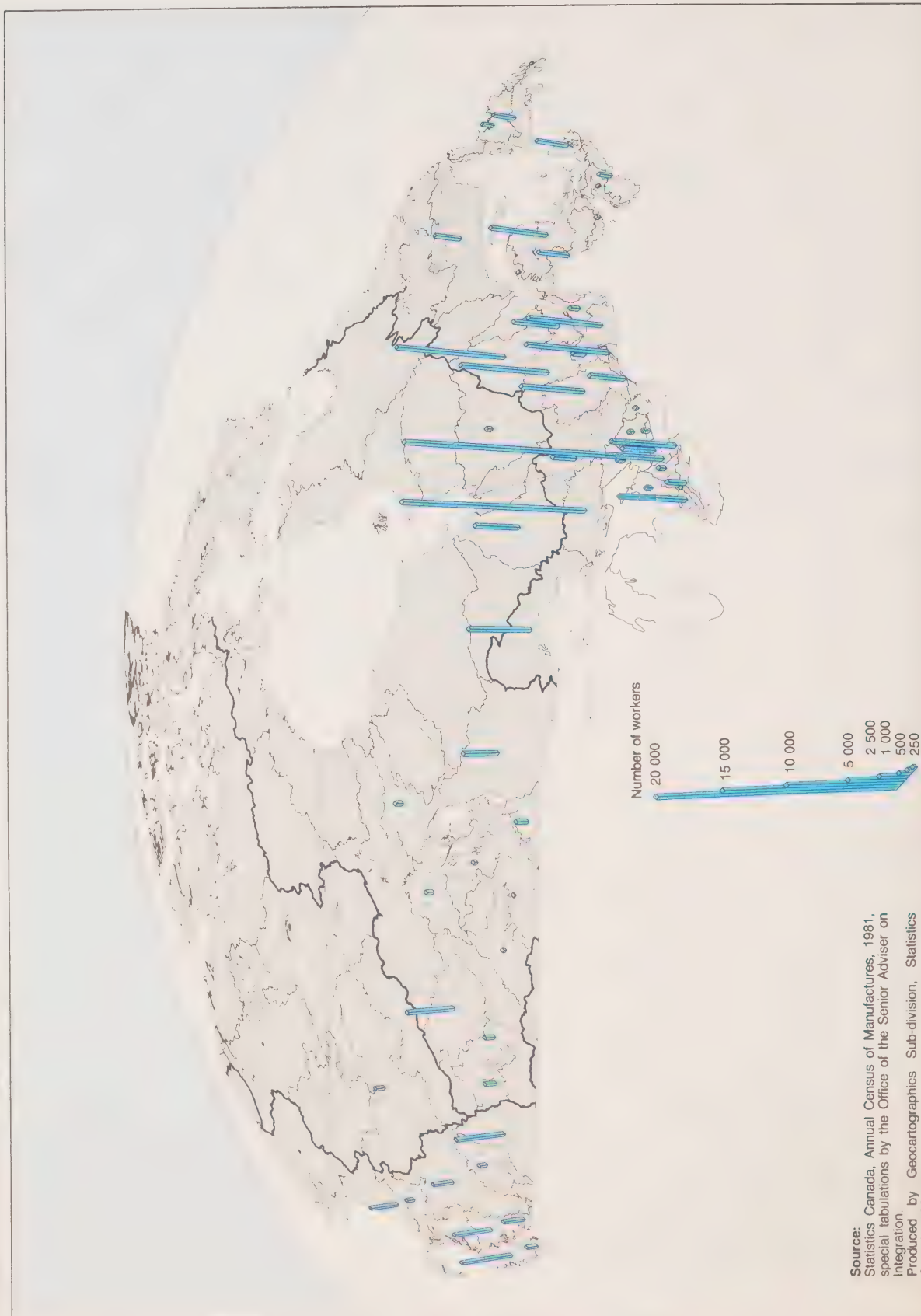
¹Census of Manufacturing introduced the Standard Geographical Code in 1973, earlier data could not be readily allocated to river basins.

²Ranges are used to meet the confidentiality restrictions of the Statistics Act. The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics. Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

Source:

Statistics Canada, Annual Census of Manufactures, 1973, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

Map 6.2.5
Production Workers in High Stressor Manufacturing Industries, by Drainage Basin, 1981



Source: Statistics Canada, Annual Census of Manufactures, 1981, special tabulations by the Office of the Senior Adviser on Integration.
Produced by Geocartographics Sub-division, Statistics Canada, 1984.

Table 6.2.6
Consumption of Fuel and Electricity¹ by Manufacturing Industries, by Ecozone, 1976 and 1981²

Ecozone	Fossil Fuel					Electricity				
			Percent Change 1976 to 1981	Percent Consumed by High Stressor Industries				Percent Change 1976 to 1981	Percent Consumed by High Stressor Industries	
	1976	1981		1976	1981	1976	1981		1976	1981
	terajoules			terajoules						
Atlantic Maritime	74 238	61 182	-17.6	75.8	70.2	25 912	38 095	47.0	86.2	87.8
Prince Edward Island	481	558	16.0	0.0	0.0	131	158	20.6	0.0	0.0
Nova Scotia	20 315	18 641	-8.2	66.7	57.0	5 799	6 799	17.2	69.6	69.0
New Brunswick	37 782	30 308	-19.8	76.3	73.2	8 944	10 934	22.2	85.8	84.4
Québec	15 661	11 676	-25.4	88.8	86.8	11 039	20 205	83.0	96.3	96.6
Mixed-Wood Plain	504 871	507 743	0.6	41.2	44.0	147 385	183 145	24.3	54.3	56.0
Québec	163 877	176 636	7.8	41.3	47.9	73 805	96 915	31.3	67.8	70.2
Ontario	340 993	331 106	-2.9	41.1	41.9	73 580	86 229	17.2	40.7	40.1
Boreal Shield	145 496	145 905	0.3	90.5	89.1	46 379	56 499	21.8	92.8	91.0
Newfoundland	12 709	10 738	-15.5	74.9	67.8	5 303	6 804	28.3	90.6	90.6
New Brunswick	0	0-99	...	...	0.0	0	0-99	...	...	0.0
Québec	38 874	44 851	15.4	90.6	90.6	15 817	17 978	13.7	91.5	88.0
Ontario	88 738	86 571	-2.4	92.9	90.3	20 529	27 979	36.3	92.9	91.8
Manitoba	2 500-2 999	1 000-1 499	-64.4	99.5	98.9	4 500-4 999	3 000-3 499	-24.6	99.9	99.8
Saskatchewan	2 000-2 499	2 500-2 999	22.0	100.0	100.0	100-199	200-499	60.9	100.0	99.7
Prairie	75 656	142 829	88.8	43.2	64.9	13 393	19 389	44.8	49.2	51.9
Manitoba	18 347	17 484	-4.7	16.0	16.1	3 650	3 864	5.9	35.5	28.6
Saskatchewan	7 972	8 492	6.5	14.3	13.0	1 882	3 054	62.3	14.3	27.8
Alberta	49 337	116 853	136.8	58.1	76.0	7 860	12 471	58.7	63.9	65.0
Boreal Plain	32 170	22 425	-30.3	70.6	54.5	2 410	4 155	72.4	58.5	62.8
Manitoba	4 507	5 305	17.7	66.7	77.0	827	2 177	163.2	87.5	95.1
Saskatchewan	6 000-6 499	4 500-4 999	-21.6	66.3	59.1	200-499	500-999	41.3	43.5	50.2
Alberta	19 500-19 999	10 500-10 999	-44.9	72.5	41.2	500-999	1 000-1 499	13.3	43.9	15.4
British Columbia	1 500-1 999	1 000-1 499	-21.1	76.1	56.9	100-199	200-499	35.7	40.8	20.7
Yukon	0	0-99	...	...	0.0	0	0-99	...	...	0.0
Montane Cordillera	41 983	42 075	0.2	60.4	56.3	15 499	8 470	-45.4	76.0	47.5
Alberta	4 746	4 498	-5.2	0.0	0.0	301	374	24.3	0.0	0.0
British Columbia	37 237	37 577	0.9	68.1	63.1	15 198	8 096	-46.7	77.5	49.7
Pacific Maritime	74 592	61 717	-17.3	74.3	69.1	23 127	24 312	5.1	74.9	71.7
British Columbia	74 592	61 717	-17.3	74.3	69.1	23 127	24 312	5.1	74.9	71.7
Boreal Cordillera	0-99	0-99	750.0	50.0	29.4	0-99	0-99	0.0	0.0	33.3
Yukon	0-99	0-99	750.0	50.0	29.4	0-99	0-99	0.0	0.0	33.3
Taiga Plain	200-499	200-499	24.2	94.3	96.9	0-99	0-99	40.0	0.0	57.1
Northwest Territories	200-499	200-499	24.2	94.3	96.9	0-99	0-99	40.0	0.0	57.1
Taiga Shield	0-99	0-99	-35.0	0.0	0.0	0-99	0-99	100.0	0.0	0.0
Newfoundland	0-99	0-99	-85.7	0.0	0.0	0	0-99	...	...	0.0
Northwest Territories	0-99	0-99	83.3	0.0	0.0	0-99	0-99	50.0	0.0	0.0
Hudson Bay Plain	0-99	0	-100.0	0.0	...	0-99	0-99	500.0	0.0	0.0
Manitoba	0-99	0	-100.0	0.0	...	0-99	0-99	500.0	0.0	0.0
Southern Arctic	0-99	0-99	0.0	0.0	0.0	0	0	...	...	...
Newfoundland	0-99	0	-100.0	0.0	...	0	0	...	...	...
Northwest Territories	0	0-99	...	...	0.0	0	0	...	...	...
Canada	949 344	984 296	3.7	56.1	57.7	274 115	334 083	21.9	66.6	66.3

Data include purchased fuel and electricity and exclude any self produced fuel and electricity, fuel used for non fuel purposes (production processes), and other energy sources such as steam or wood. Figures apply only to larger establishments reporting detail in their manufacturing and non-manufacturing (e.g. transportation, space heating) operations. Ranges are used to meet the confidentiality restrictions of the Statistics Act.

Source:
Statistics Canada, Annual Census of Manufactures, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration

Table 6.2.7

Consumption of Fuel and Electricity¹ by Manufacturing Industries, by Major Drainage Area, 1976 and 1981²

Major Drainage Area	Fossil Fuel					Electricity				
			Percent Change 1976 to 1981	Percent Consumed by High Stressor Industries				Percent Change 1976 to 1981	Percent Consumed by High Stressor Industries	
	1976	1981		1976	1981	1976	1981		1976	1981
	terajoules					terajoules				
Atlantic Ocean Basin	698 187	689 393	-1.2	53.2	54.3	207 202	264 849	27.8	64.6	66.5
Atlantic Ocean Coastal	7 531	7 044	-6.5	58.3	61.2	2 810	3 618	28.7	70.2	73.1
Gulf of St. Lawrence Coastal	52 938	42 667	-19.4	86.8	82.0	20 348	30 409	49.4	92.2	93.5
Bay of Fundy Coastal and Saint John River	25 703	22 711	-11.6	59.0	52.7	6 355	8 474	33.3	73.8	72.9
St. Lawrence River	194 553	212 446	9.2	45.6	51.2	84 231	109 330	29.8	69.1	70.6
Ottawa River	33 424	31 214	-6.6	78.8	78.7	11 846	14 568	23.0	84.9	84.4
Lake Ontario Shore	178 228	166 500	-6.6	31.0	31.2	46 958	52 313	11.4	41.8	39.5
Lake Erie and Lake St. Clair Shore	114 855	130 851	13.9	50.0	57.4	17 164	21 659	26.2	33.0	35.6
Lake Huron Shore	68 174	52 335	-23.2	85.6	78.8	12 120	16 275	34.3	81.2	81.9
Lake Superior Shore	22 781	23 625	3.7	86.4	89.6	5 370	8 203	52.8	92.3	93.6
Hudson Bay and Ungava Bay Basin	127 500-127 999	189 500-189 999	48.7	55.2	65.6	28 000-28 499	36 000-36 499	28.4	69.3	66.2
Hudson Bay and Ungava Bay Coastal	13 409	12 323	-8.1	88.2	77.6	4 537	5 713	25.9	81.8	75.0
Nelson River	100-199	0-99	-52.0	98.7	94.5	2 500-2 999	2 000-2 499	-21.6	99.9	99.8
Lake Winnipeg Shore	31 141	30 472	-2.1	43.9	45.9	7 808	8 751	12.1	67.2	65.8
Assiniboine River	8 602	8 468	-1.6	34.3	29.0	2 421	2 883	19.1	44.4	36.1
Saskatchewan River	74 358	138 512	86.3	56.3	71.0	10 454	16 452	57.4	62.8	64.2
Arctic Ocean Basin	11 878	7 000-7 499	-38.7	83.8	58.8	620	989	59.5	28.1	24.5
Mackenzie River	11 878	7 282	-38.7	83.8	58.8	620	989	59.5	28.1	24.5
Arctic Ocean Coastal	0	0-99	...	...	0.0	0	0	...	...	...
Pacific Ocean Basin	111 500-111 999	97 500-97 999	-12.4	72.3	66.6	38 000-38 499	32 000-32 499	-15.7	76.1	66.3
Columbia River	12 418	12 565	1.2	73.7	73.6	9 287	1 937	-79.1	90.0	43.5
Fraser River	43 901	45 390	3.4	50.2	42.4	11 224	12 566	12.0	43.4	37.9
Yukon River	0-99	0-99	750.0	50.0	35.3	0-99	0-99	0.0	0.0	33.3
Pacific Ocean, North Coastal	14 217	10 881	-23.5	95.3	88.2	1 626	1 754	7.9	79.6	71.5
Pacific Ocean, South Coastal	41 067	28 898	-29.6	87.7	93.4	16 114	15 969	-0.9	90.4	90.9
Gulf of Mexico Basin	0-99	0-99	50.0	0.0	0.0	0-99	0-99	350.0	0.0	0.0
Missouri River	0-99	0-99	50.0	0.0	0.0	0-99	0-99	350.0	0.0	0.0
Canada	949 344	984 296	3.7	56.1	57.7	274 115	334 083	21.9	66.6	66.3

¹ Data include purchased fuel and electricity and exclude any self produced fuel and electricity, fuel used for non fuel purposes (production processes), and other energy sources such as steam or wood. Figures apply only to larger establishments reporting detail in their manufacturing and non-manufacturing (e.g. transportation, space heating) operations.

² Ranges are used to meet the confidentiality restrictions of the Statistics Act.

Source: Statistics Canada, Annual Census of Manufactures, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

Table 6.2.8
Heavy Metals: Major End Use by Manufacturing Industries¹, 1961 to 1982

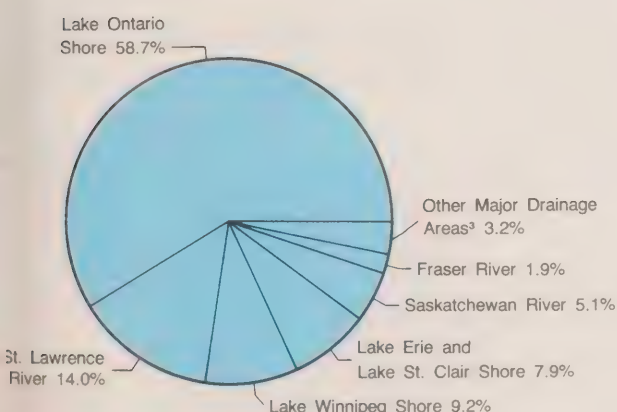
	1961	1966	1971	1976	1981	1982
percent						
Lead:²						
Used in the Production of:						
Batteries and Battery Oxides	39.0	38.7	39.7	46.7	47.9	34.5
Chemicals	20.6	16.5	19.3	17.6	17.7	18.3
Other ³	40.4	44.8	41.0	35.7	34.4	47.2
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total Tonnes Used	65 487	92 067	80 240	117 588	110 931	116 115
percent						
Metallic Cadmium:						
Used in the Production of:						
Plating	86.2	78.8	74.0	48.6	47.0	45.5
Solders	10.8	8.5	3.7	6.3	4.1	0.7
Other ⁴	3.0	12.7	22.3	45.1	48.9	53.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total Kilograms Used	77 555	77 386	53 250	53 816	34 092	33 818
percent						
Metallic Mercury:						
Used in the Production of:						
Heavy Chemicals (Electrolytic Cells)	64.0	85.1	93.8	47.8	17.6	14.8
Electrical Apparatus	2.1	12.9	5.4	47.1	8.8	14.1
Gold Recovery	2.7	1.3	0.5	0.9	..	..
Other ⁴	31.2	0.7	0.3	4.2	73.6	71.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total Kilograms Used	68 307	77 832	87 984	26 039	35 635	38 746

Data is collected only for major consumers of these heavy metals.
Includes recycled lead.
Includes antimonial lead, cable covering, copper and lead alloys, semi-finished products and other lead products.
Includes chemicals, pigments and alloys other than solders.
Includes pharmaceuticals and fine chemicals and, starting in 1981, gold recovery.

Sources:
Statistics Canada, *Metals and Minerals*, Catalogue 41-010 for years 1961, 1966, 1971 and 1976.
Energy Mines and Resources Canada, *Canadian Minerals Yearbook*, 1982, Mineral Report no. 32.

Chart 6.2.9
Lead Used¹ by Manufacturing Industries, by Major Drainage Area, 1981

Total Quantity: 173.9 tonnes²



¹ Data are obtained from the 1981 Census of Manufactures and include lead and lead alloy scrap, antimonial lead and lead in primary forms.

² Note that lead consumption in Table 6.2.8 is only the lead inputs to the major lead using industries whereas the data here include all lead inputs reported in the Manufactures Census. The latter is probably also incomplete since establishments using small quantities of lead do not report these inputs.

³ Gulf of St. Lawrence Coastal, Bay of Fundy Coastal and Saint John River, Ottawa River, Lake Huron Shore and Pacific Ocean, South Coastal.

Source:
Statistics Canada, Annual Census of Manufactures, 1981, special tabulation by the Office of the Senior Adviser on Integration.

Table 6.2.10
Manufacturing Water Use by Industry Group, 1981¹

Industry Group	Number of Plants	Total Water Intake ²	Recirculated ³	Gross Water Use ⁴	Consumption ⁵	Total Water Discharge ⁶	Use Rate ⁷	Consumption Rate ⁸
millions of cubic metres								percent
Paper and Allied	271	2 899	4 612	7 511	159	2 740	2.6	5.5
Chemical and Chemical Products	572	2 853	1 284	4 137	197	2 656	1.4	6.9
Primary Metals	171	2 719	1 692	4 411	38	2 681	1.6	1.4
Petroleum and Coal Products	42	563	1 457	2 020	34	529	3.6	6.0
Food and Beverage	1 513	430	117	547	31	399	1.3	7.2
Textiles	162	124	50	174	6	118	1.4	4.8
Transportation Equipment	329	109	73	182	3	106	1.7	2.7
Non-Metallic Mineral Products	674	83	530	613	15	68	7.4	18.1
Wood	360	73	57	130	4	69	1.8	5.5
Rubber and Plastics	450	54	744	798	7	47	14.8	13.0
Metal Fabricating	324	30	130	160	1	29	5.3	2.6
Total	4 868	9 936	10 747	20 683	494	9 442	2.1	5.0

¹ Data obtained from the 1981 survey of Industrial Water Use. Only the larger establishments (i.e. those that had received the long-form questionnaires during the 1981 Census of Manufactures) and the eleven major SIC industrial groups identified as the largest users of water in manufacturing were covered by this survey. Of these industrial groups some of the minor water-using components identified in the 1976 Water Use Survey were eliminated. See Appendix 6, Table 5 for a 1976 breakdown of manufacturing water use by industry group.

² Total amount of water added to the water system of the plant to replace water discharged or consumed during production.

³ Water used at least twice in the manufacturing process.

⁴ New water intake plus recycled water.

⁵ Water which is lost in the production process.

⁶ Water returned to the environment.

⁷ The ratio of gross water use to water intake; represents an index of recirculation.

⁸ Proportion of the water lost during production, most commonly through evaporation or incorporation of water into products.

Source:

Environment Canada, Inland Waters Directorate, *Water Use in the Canadian Manufacturing Industry, 1981* by D.M. Tate and D.N. Scharf, unpublished.

Note:

Individual items may not add to totals due to rounding.

Table 6.2.11
Manufacturing Water Use by Major Drainage Area, 1976¹

Major Drainage Area	Total Water Intake ²	Recirculated ³	Gross Water Use ⁴	Consumption ⁵	Total Water Discharged ⁶	Use Rate ⁷	Consumption Rate ⁸
	millions of cubic metres						percent
Atlantic Ocean Basin	6 479	7 127	13 603	317	6 160	2.1	4.9
Atlantic Ocean Coastal	320	237	555	8	311	1.7	2.5
Gulf of St. Lawrence Coastal	551	588	1 138	23	527	2.1	4.2
Bay of Fundy Coastal and Saint John River	201	336	537	22	179	2.7	10.9
St. Lawrence River	1 665	1 877	3 542	89	1 577	2.1	5.3
Ottawa River	298	622	920	16	281	3.1	5.4
Lake Ontario Shore	1 445	1 578	3 023	61	1 383	2.1	4.2
Lake Erie and Lake St. Clair Shore	1 025	839	1 865	75	951	1.8	7.3
Lake Huron Shore	739	500	1 238	15	723	1.7	2.0
Lake Superior Shore	235	550	785	8	228	3.3	3.4
Hudson Bay and Ungava Bay Basin	556	1 846	2 401	50	506	4.3	9.0
Hudson Bay and Ungava Bay Coastal	170	114	284	7	164	1.7	4.1
Elson River	49	10	59	0	49	1.2	0.0
Lake Winnipeg Shore	164	515	678	11	152	4.1	6.7
Assiniboine River	11	81	92	4	7	8.4	36.4
Saskatchewan River	162	1 126	1 288	28	134	8.0	17.3
Arctic Ocean Basin	126	26	153	9	117	1.2	7.1
MacKenzie River	126	26	153	9	117	1.2	7.1
Arctic Ocean Coastal	0	0	0	0	0		
Pacific Ocean Basin	1 501	2 363	3 864	80	1 421	2.6	5.3
Columbia River	209	181	390	13	196	1.9	6.2
Fraser River	418	593	1 012	27	391	2.4	6.5
Stikine River	0	0	0	0	0	...	...
Pacific Ocean, North Coastal	155	74	229	3	152	1.5	1.9
Pacific Ocean, South Coastal	719	1 515	2 233	37	682	3.1	5.1
Gulf of Mexico Basin	0	0	0	0	0	...	...
Missouri River	0	0	0	0	0	...	...
Canada	8 664	11 360	20 024	456	8 207	2.3	5.3

Data obtained from the 1976 Water Use Survey. Only the larger establishments (i.e. those receiving the long form questionnaire) during the 1976 Census of Manufactures and the ten major SIC industrial groups identified as the largest users of water in manufacturing were covered by this survey. Due to technical difficulties it was not possible to provide a breakdown by Major Drainage Area by using the 1981 Water Use Survey. Total amount of water added to the water system of the plant to replace water discharged or consumed during production. Water used at least twice in the manufacturing process. New water intake plus recycled water. Water which is lost in the production process.

⁶ Water returned to the environment.

⁷ The ratio of gross water use to water intake; represents an index of recirculation.

⁸ Proportion of the water lost during production, most commonly through evaporation or incorporation of water into products.

Source:

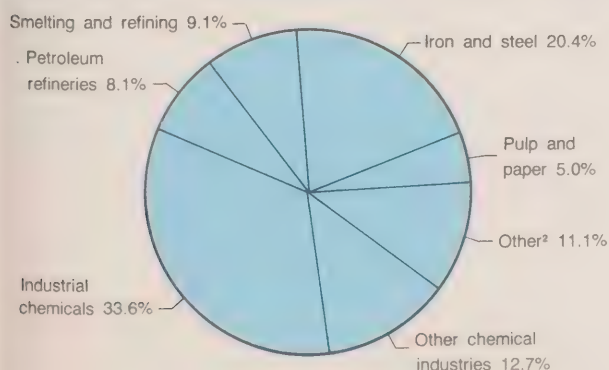
Environment Canada, Water Use in Manufacturing Industries, 1976 survey, special tabulation by Office of the Senior Adviser on Integration Statistics Canada.

Note:

Individual items may not add to totals due to rounding.

Chart 6.2.12
Hazardous Waste Generated by Manufacturing Industries¹

Total Quantity: 3.3 million tonnes per year in wet weight



¹ The estimates for hazardous waste were derived for Canada by applying American (Environmental Protection Agency) industrial hazardous waste coefficients to corresponding Canadian industrial activity. The 1980 employment figures by industry were used as an allocator. The data were obtained from a special study (Canadian National Inventory of Hazardous and Toxic Wastes) prepared for Environment Canada. These data should be treated as approximate values. For a detailed listing of hazardous wastes see "Interim List of Environmentally Dangerous Wastes of the Transportation of Dangerous Goods Act", Bill C-18, Canada, July 17, 1980.

² Includes metal fabricating industries (207.4 thousand tonnes per year), textile industries (49.1 thousand tonnes per year), transportation equipment industries (32.8 thousand tonnes per year) and other minor sources.

Source:

Environment Canada, Environmental Protection Service, Canadian National Inventory of Hazardous and Toxic Wastes, January 1982. (special study prepared by Gore and Storrie, Limited).

Table 6.2.13
Pollutants Loadings¹ to Water by Pulp and Paper Mills, by Major Drainage Area, 1973, 1976 and 1982

Major Drainage Area	1973				1976				1982			
	Number of Mills ²	Production ³	BOD ₅	Total Suspended Solids (TSS)	Number of Mills ²	Production ³	BOD ₅	Total Suspended Solids (TSS)	Number of Mills ²	Production ³	BOD ₅	Total Suspended Solids (TSS)
		tonnes per day				tonnes per day				tonnes per day		
Atlantic Ocean Basin	79	39 019	2 210	1 324	82	36 879	2 235	1 002	84	38 590	1 834	733
Atlantic Ocean Coastal	3	1 664	85	84	3	1 438	93	72	3	1 289	71	38
Gulf of St. Lawrence Coastal	13	8 285	524	264	13	6 950	507	164	13	7 134	432	140
Bay of Fundy Coastal and Saint John River	4	2 432	128	45	7	3 065	248	88	9	3 609	72	38
St. Lawrence River	29	14 415	891	684	29	13 777	765	414	29	14 255	703	336
Ottawa River	11	4 175	139	133	11	4 274	319	157	10	4 031	246	111
Lake Ontario Shore	9	1 964	67	29	9	1 881	43	22	9	1 782	22	14
Lake Huron Shore	3	1 522	111	37	3	1 317	60	35	4	1 416	48	20
Lake Superior Shore	7	4 562	265	48	7	4 177	200	50	7	5 074	190	36
Hudson Bay and Ungava Bay Basin	13	6 961	392	164	11	6 000-6 499	429	137	11	6 500-6 999	253	75
Hudson Bay and Ungava Bay Coastal	5	3 122	227	105	5	2 984	269	68	5	3 228	159	37
Lake Winnipeg Shore	5	2 602	147	49	4	2 299	138	59	4	2 598	85	27
Saskatchewan River	3	1 237	18	10	2	1 000-1 499	22	10	2	1 000-1 499	9	11
Arctic Ocean Basin	2	1 000-1 499	14	14	3	1 809	18	23	4	2 092	12	20
Mackenzie River	2	1 000-1 499	14	14	3	1 809	18	23	4	2 092	12	20
Pacific Ocean Basin	20	16 000-16 499	1 013	479	21	14 500-14 999	570	362	21	16 000-16 499	351	236
Columbia River	2	500-999	32	22	2	500-999	22	20	2	500-999	29	11
Fraser River	6	3 852	50	38	7	3 425	27	44	8	4 380	26	38
Pacific Ocean, North Coastal	3	1 711	443	118	3	1 633	36	43	2	1 500-1 999	50	26
Pacific Ocean, South Coastal	9	9 986	488	301	9	8 660	485	255	9	9 168	246	161
Canada	114	63 949	3 629	1 981	117	59 682	3 252	1 524	120	63 848	2 450	1 064

¹ Pollutant loadings are estimated for individual plants and are based on daily production, process technology and pollution abatement equipment installed. These are calculated for Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD₅). These measures are used to control the amount of effluent discharge by the Pulp and Paper industry under the Pulp and Paper Effluent Regulations of the Federal Fisheries Act. These data should be treated as approximations rather than "measured values". Note: Figures do not include small mills and those that discharge into municipal treatment systems and for this reason underestimation occurs in some areas.

² Due to new mill openings, shut downs and occasional non-reporting, the number of mills does not always refer to the same set of establishments.

³ A range is used in order to meet the confidentiality restrictions of the Statistics Act for drainage areas with a small number of mills.

Source:

Environment Canada, Environmental Protection Service, unpublished data.

Table 6.2.14

Water Pollution Compliance Levels of Pulp and Paper Mills, by Major Drainage Area, 1982¹

Major Drainage Area	Number of Mills ²	Biochemical Oxygen Demand (BOD ₅)				Total Suspended Solids (TSS)			
		Loadings	Compliance Level ²	Compliance Index ³	Number of Mills Not in Compliance	Loadings	Compliance Level ²	Compliance Index ³	Number of Mills Not in Compliance
		tonnes per day	tonnes per day			tonnes per day	tonnes per day		
Atlantic Ocean Basin	84	1 834	1 526	1.2	37	733	555	1.3	40
Atlantic Ocean Coastal	3	71	55	1.3	1	38	16	2.4	1
Gulf of St. Lawrence Coastal	13	432	356	1.2	7	140	104	1.3	7
Bay of Fundy Coastal and Saint John River	9	72	58	1.2	3	38	37	1.0	4
St. Lawrence River	29	703	551	1.3	16	336	203	1.7	19
Ottawa River	10	246	189	1.3	4	111	54	2.1	6
Lake Ontario Shore	9	22	39	0.6	1	14	17	0.8	1
Lake Huron Shore	4	98	54	1.8	2	20	27	0.7	1
Lake Superior Shore	7	190	224	0.8	3	36	97	0.4	1
Hudson Bay and Ungava Bay Basin	11	253	292	0.9	4	75	99	0.8	4
Hudson Bay and Ungava Bay Coastal	5	159	156	1.0	2	37	49	0.8	1
Lake Winnipeg Shore	4	85	86	1.0	2	27	42	0.6	1
Saskatchewan River	2	9	50	0.2	0	11	8	1.4	2
Arctic Ocean Basin	4	12	70	0.2	0	20	22	0.9	1
Mackenzie River	4	12	70	0.2	0	20	22	0.9	1
Pacific Ocean Basin	21	351	684	0.5	2	236	150	1.6	15
Columbia River	2	29	44	0.7	1	11	8	1.4	2
Fraser River	8	26	143	0.2	0	38	30	1.3	4
Pacific Ocean, North Coastal	2	50	67	0.7	1	26	14	1.9	2
Pacific Ocean, South Coastal	9	246	430	0.6	0	161	98	1.6	7
Canada	120	2 450	2 572	1.0	43	1 064	826	1.3	60

¹ Loadings are presented in terms of Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD₅). Note: figures do not include small mills and those that discharge into municipal treatment systems; for this reason underestimation occurs in some areas.

² Compliance refers to permitted deposits of either BOD₅ and TSS in pounds per air-dry ton of product rather than the assimilative capacity of receiving waters. Further, note that the compliance is variable according to the technology in place at the plant.

³ Index value of one or less indicates that the compliance has been met, a value greater than one indicates that the mills are discharging effluents which exceed compliance.

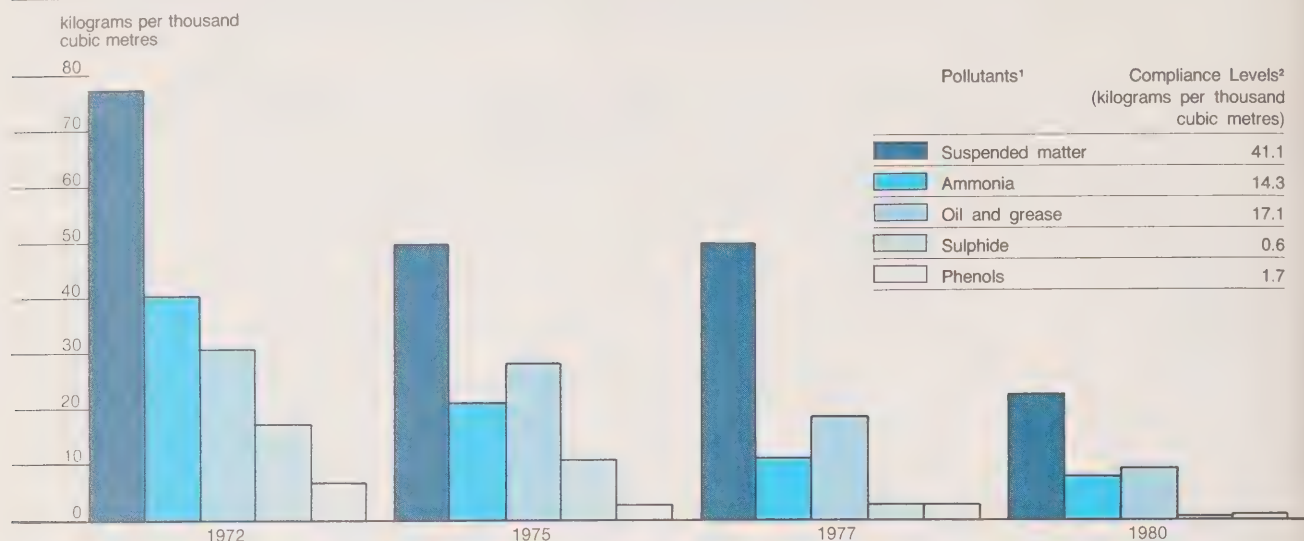
Source:

Environment Canada, Environmental Protection Service, unpublished data.

Note:

The Environmental Protection Service of Environment Canada acting under the authority of pulp and paper effluent regulations of the Federal Fisheries Act sets individual compliance levels for each plant.

Chart 6.2.15

Pollutant Loadings to Water by Petroleum Refineries, 1972 to 1980

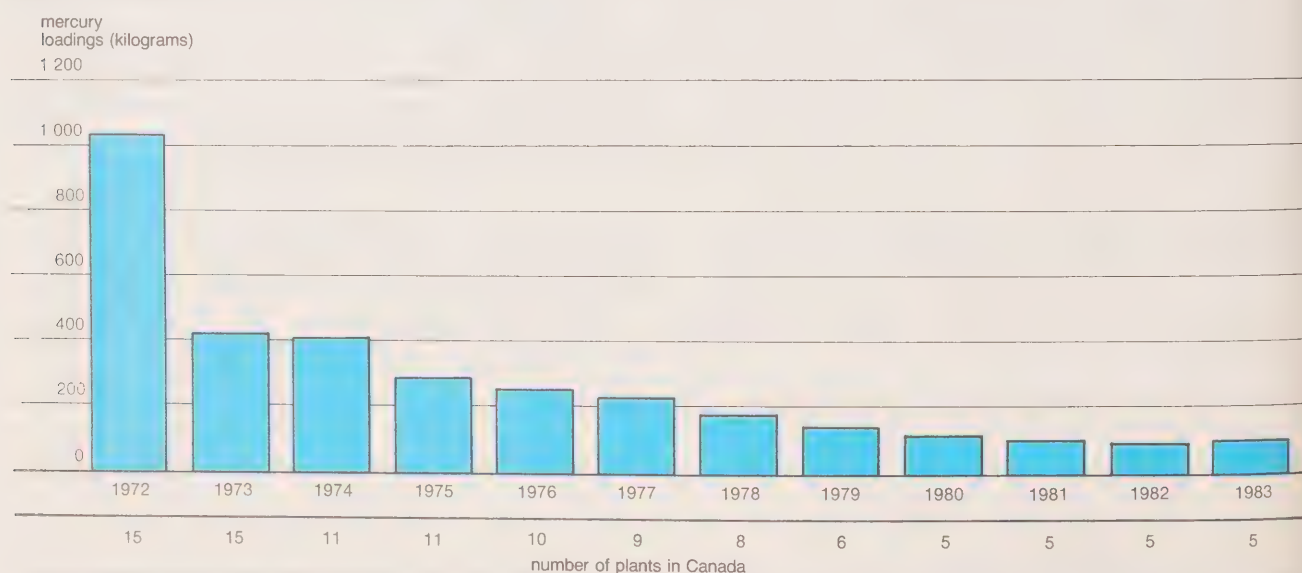
¹ These substances are monitored by Environment Canada under the Petroleum Refinery Effluent Regulations and Guidelines pursuant to the Federal Fisheries Act of 1973.

² Compliance levels are in kilograms per thousand cubic metres of crude oil refined and allowable discharge is variable according to the technology in place at the refinery.

Source:

Environment Canada, *Status Report on Abatement of Water Pollution from the Canadian Petroleum Refining Industry, 1980*, Report EPS 3-WP-83-3, 1983.

Chart 6.2.16

Mercury Loadings to Water by Chlor-Alkali Plants¹, 1972 to 1983

¹ In 1972, May to December only; total for the year would be somewhat higher.

Source:

Environment Canada, Environmental Protection Service, *Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1982-1983*, by J. McBeath, Report EPS1/HA/1, March 1985.

Note:

In 1972, chlor-alkali plants became regulated under the Federal Fisheries Act. The regulations state that deposition of mercury to water may not exceed 2.5 grams per tonne of chlorine produced. In 1983, all plants remaining in operation had complied.

6.3

Thermal Energy Generation

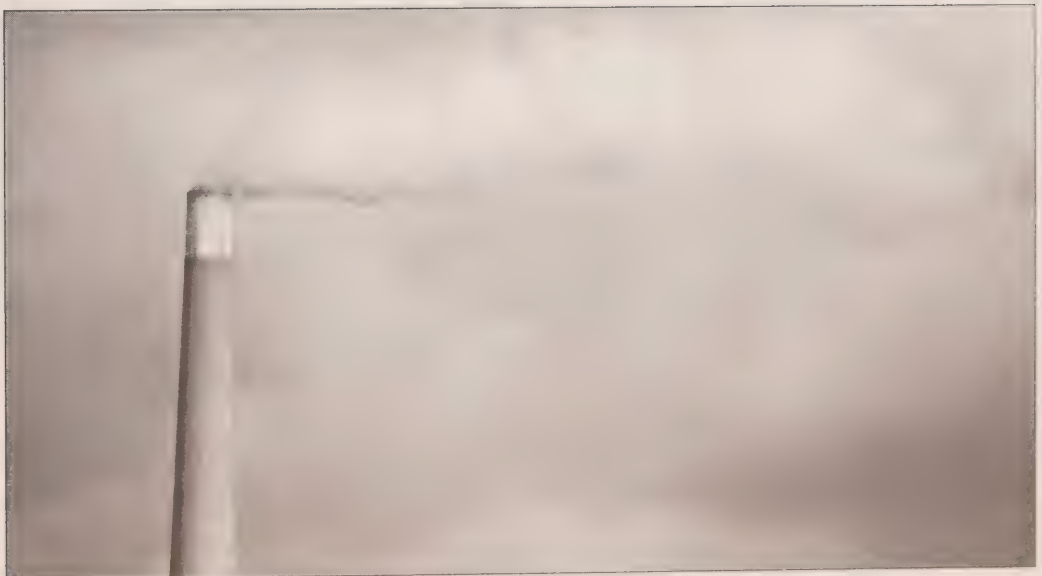
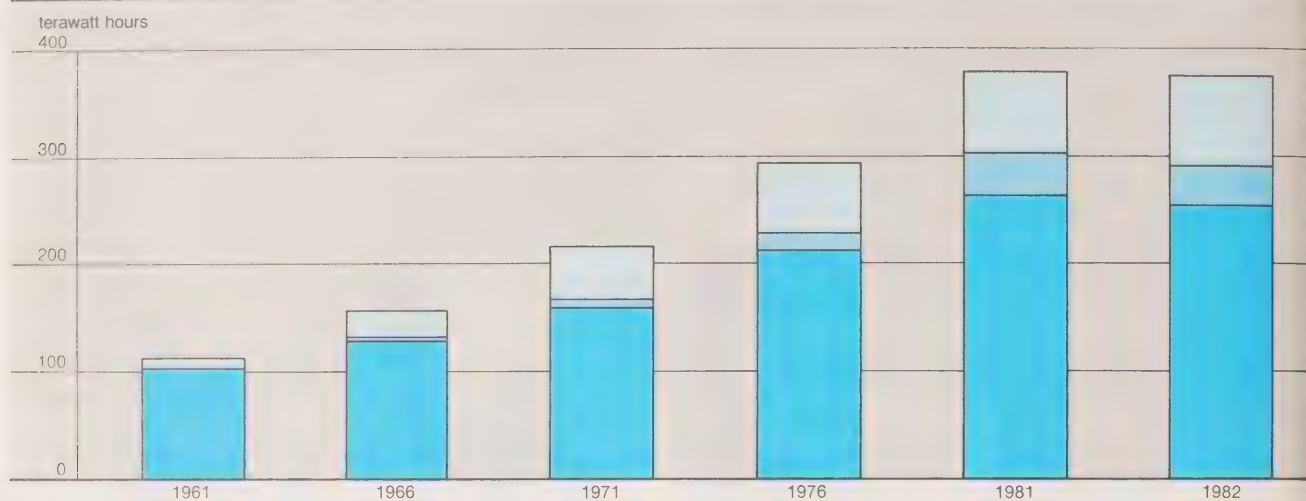


Chart 6.3.1
Generation¹ of Electricity, 1961 to 1982



¹ Net generation i.e. total generation less energy used in generating station service. This includes power generated by utilities and industries for their own use.

² Other thermal includes internal combustion and gas turbine.

Source:
Statistics Canada, *Electric Power Statistics*, Volume II, Catalogue 57-202, various years.

Steam and other thermal²
Nuclear
Hydro

Table 6.3.2
Generation¹ of Electricity² by Province/Territory, 1982

	Hydro		Thermal				Total
		Steam	Nuclear	Internal Combustion	Gas Turbine	Total Thermal	
gigawatt hours							
Newfoundland	43 096	1 146	0	90	8	1 244	44 340
Prince Edward Island	0	34	0	<1	<1	35	35
Nova Scotia	1 025	5 542	0	0	1	5 543	6 568
New Brunswick	2 645	5 536	254	<1	<1	5 790	8 435
Québec	99 810	23	0	207	-4	227	100 037
Ontario	37 611	35 881	35 899	2	1 046	72 828	110 439
Manitoba	20 495	243	0	52	<1	295	20 790
Saskatchewan	2 360	7 411	0	14	61	7 486	9 846
Alberta	1 590	24 026	0	64	1 432	25 522	27 112
British Columbia	46 126	1 980	0	280	-24	2 236	48 363
Yukon	272	0	0	72	0	72	344
Northwest Territories	275	0	0	222	0	222	497
Canada	255 306	81 823	36 154	1 003	2 520	121 499	376 805

¹ Net generation is total generation less energy used in generating station service, the negative figures which appear in several places result from this calculation.

² Includes electricity generated by both electric utilities and industrial establishments.

Source:

Statistics Canada, *Electric Power Statistics*, Volume II, Catalogue 57-202, 1982.

Note:

Individual items may not add to totals due to rounding.

Table 6.3.3
Fuel Consumption by Thermal Generating Stations¹, 1961 to 1982

	Coal				Petroleum Fuels				Natural Gas	Uranium
	Bituminous	Sub-bituminous	Lignite	Total	Light Fuel Oil	Heavy Fuel Oil	Diesel	Total		
kilotonnes					megalitres				million cubic metres	tonnes
1961	863	211	971	2 044	13	332	51	397 ²	1 168	
1966	4 599	1 565	984	7 148	31	771	149	952 ³	1 820	
1971	9 358	3 684	2 574	15 616	114	1 683	154	1 957 ⁴	1 992	
1976	8 976	6 132	4 032	19 140	111	2 792	271	3 174	3 223	282
1981	13 413	10 970	5 545	29 928	104	1 687	189	1 980	1 335	677
1982	14 115	12 672	6 770	33 557	91	1 852	192	2 134	1 095	637

¹ Public utilities only.

² Includes 1.3 megalitres of crude oil used in British Columbia.

³ Includes 1.1 megalitres of crude oil used in British Columbia.

⁴ Includes 0.2 megalitres of jet fuel used in Manitoba and 5.3 megalitres of crude oil used in British Columbia.

Source:

Statistics Canada, *Electric Power Statistics*, Volume II, Catalogue 57-202, for years 1961, 1966, 1971, 1976, 1981, and 1982.

Note:

Individual items may not add to totals due to rounding.

Table 6.3.4
Fuel Consumption by Thermal Generating Stations, by Ecozone, 1981¹

Ecozone	Coal				Petroleum Fuels	Natural Gas	Nuclear	Total
	Bituminous		Sub- bituminous	Lignite				
	Canadian	Foreign						
terajoules								
Atlantic Maritime	48 068	0	0	0	64 126	0	0	112 194
Prince Edward Island	0	0	0	0	769	0	0	769
Nova Scotia	32 974	0	0	0	24 119	0	0	57 092
New Brunswick	15 094	0	0	0	38 008	0	0	53 103
Québec	0	0	0	0	1 231	0	0	1 231
Mixed-Wood Plain	69 417	260 623	0	0	4 191	339	135 373	469 944
Québec	0	0	0	0	511	0	0	511
Ontario	69 417	260 623	0	0	3 681	339	135 373	469 433
Boreal Shield	0	4 333	0	4 328	7 650	0	703	17 014
Newfoundland	0	0	0	0	6 274	0	0	6 274
Québec	0	0	0	0	467	0	0	467
Ontario	0	4 333	0	4 328	323	0	703	9 687
Manitoba	0	0	0	0	585	0	0	585
Saskatchewan	0	0	0	0	--	0	0	--
Prairie	0	0	39 911	80 638	787	45 294	0	166 629
Manitoba	0	0	0	4 815	7	8	0	4 829
Saskatchewan	0	0	1 875	75 823	738	5 511	0	83 948
Alberta	0	0	38 035	0	42	39 775	0	77 852
Boreal Plain	16 670	0	176 888	116	443	3 446	0	197 563
Manitoba	0	0	0	116	9	0	0	125
Saskatchewan	0	0	0	0	145	0	0	145
Alberta	16 670	0	176 888	0	104	2 742	0	196 404
British Columbia	0	0	0	0	61	704	0	764
Yukon	0	0	0	0	125	0	0	125
Montane Cordillera	0	0	0	0	230	289	0	519
Alberta	0	0	0	0	--	289	0	290
British Columbia	0	0	0	0	229	0	0	229
Pacific Maritime	0	0	0	0	805	325	0	1 130
British Columbia	0	0	0	0	805	325	0	1 130
Boreal Cordillera	0	0	0	0	1 008	0	0	1 008
British Columbia	0	0	0	0	68	0	0	68
Yukon	0	0	0	0	940	0	0	940
Taiga Plain	0	0	0	0	672	0	0	672
Alberta	0	0	0	0	3	0	0	3
Northwest Territories	0	0	0	0	669	0	0	669
Taiga Shield	0	0	0	0	526	0	0	526
Northwest Territories	0	0	0	0	526	0	0	526
Hudson Bay Plain	0	0	0	0	30	0	0	30
Manitoba	0	0	0	0	30	0	0	30
Southern Arctic	0	0	0	0	694	0	0	694
Northwest Territories	0	0	0	0	694	0	0	694
Northern Arctic	0	0	0	0	523	0	0	523
Northwest Territories	0	0	0	0	523	0	0	523
Arctic Cordillera	0	0	0	0	53	0	0	53
Northwest Territories	0	0	0	0	53	0	0	53
Canada	134 155	264 956	216 799	85 082	81 737	49 693	136 076	968 498

¹ Public utilities only.

Source:

Statistics Canada, Thermal Generating Stations Fuel Consumption Survey, special tabulation by the Office of the Senior Adviser on Integration.

Note:

Individual items may not add to totals due to rounding.

Table 6.3.5
Consumption of Coal by Thermal Generating Stations and Other Industries, by Ecozone, 1981

Ecozone	Thermal Generating Stations	Cement Manufac- turers	Smelting and Refining	Pulp and Paper	Other ¹	Total	Percent Distribution
thousands of tonnes							
Atlantic Maritime	1 641	83	1	0	191	1 916	6.0
Nova Scotia	1 126	49	0	0	191	1 367	4.3
New Brunswick	515	33	0	0	0	549	1.7
Quebec	0	0	1	0	0	1	
Mixed-Wood Plain	11 034	374	247	1	176	11 832	37.1
Quebec	0	92	247	--	65	404	1.3
Ontario	11 034	283	0	--	111	11 428	35.9
Boreal Shield	427	0	103	212	22	763	2.4
Quebec	0	0	46	18	22	85	0.3
Ontario	427	0	0	194	--	621	1.9
Manitoba	0	0	58	0	0	58	0.2
Prairie	7 851	0	0	0	396	8 247	25.9
Manitoba	321	0	0	0	95	417	1.3
Saskatchewan	5 036	0	0	0	0	5 036	15.8
Alberta	2 494	0	0	0	300	2 794	8.8
Boreal Plain	8 962	0	0	86	15	9 063	28.4
Manitoba	11	0	0	86	15	112	0.4
Alberta	8 951	0	0	0	0	8 951	28.1
Montane Cordillera	0	0	49	0	0	49	0.2
British Columbia	0	0	49	0	0	49	0.2
Canada	29 915	457	400	297	800	31 870	100.0

¹ Includes industries such as industrial chemicals (inorganic), miscellaneous petroleum and coal products, and iron and steel.

Note:
Individual items may not add to totals due to rounding.

Source:
Statistics Canada, Industrial Consumers of Energy, Quarterly Survey, special tabulation by the Office of the Senior Adviser on Integration.

Technical Box 6.3.6

Composition of Canadian Coals

Characteristics	Nova Scotia Bituminous	New Brunswick Bituminous	Saskatchewan Lignite	Alberta Sub-bituminous	Imports from the United States
percent of content					
Moisture	5.0	7.5	34.4	21.1	5.1
Ash	8.7	10.1	14.2	16.7	8.8
Volatile Matter	32.5	29.8	24.3	26.0	36.9
Fixed Carbon	53.8	52.6	27.1	36.2	49.2
Total	100.0	100.0	100.0	100.0	100.0
Sulphur ¹	2.2	4.6	0.5	0.2	2.4
kilojoules per kilogram of coal					
Heating Value	30 856	28 752	13 920	17 794	29 673

¹ Sulphur occurs in the ash, volatile matter and fixed carbon. The figures present the sulphur content expressed as a percentage of the total weight.

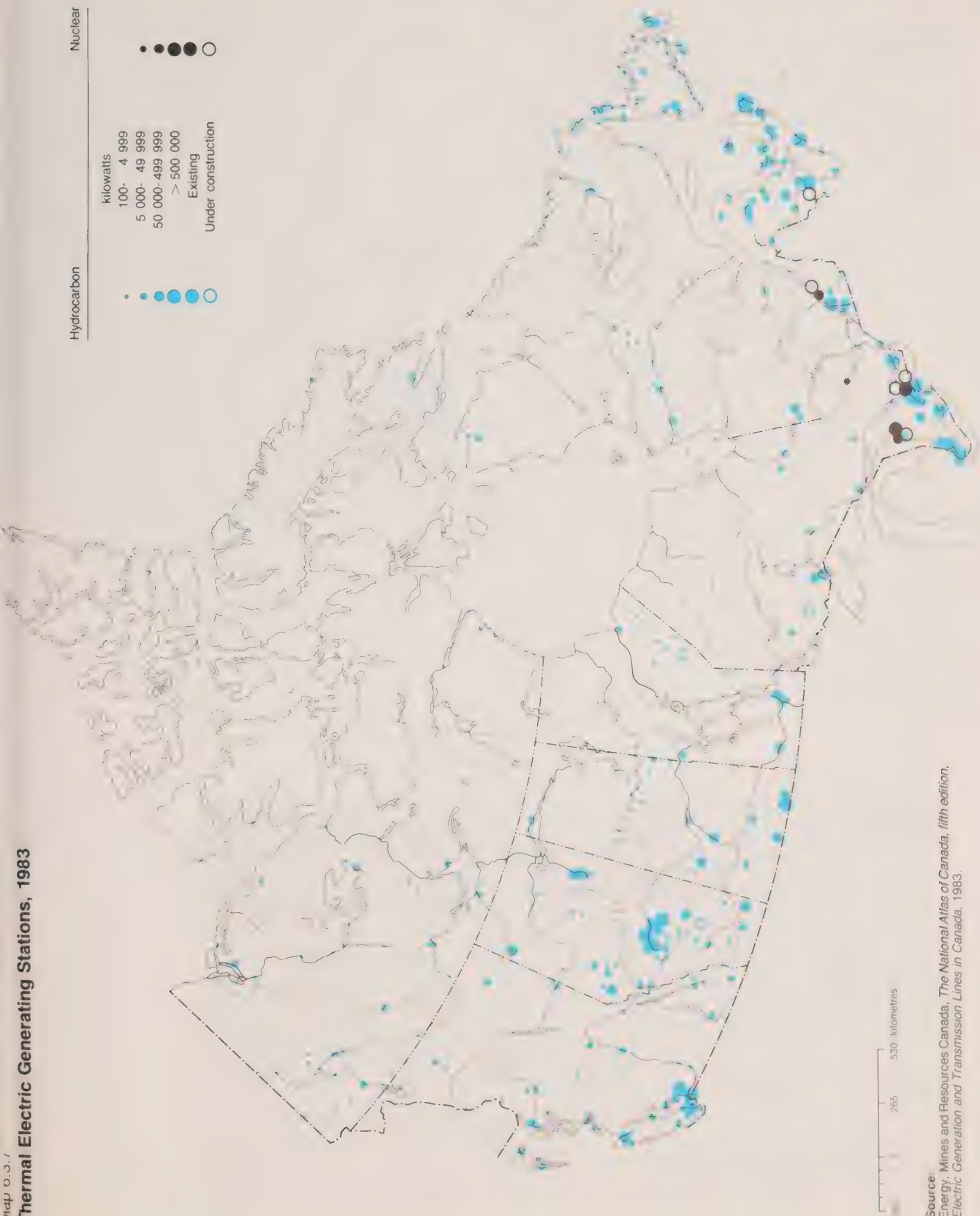
Source:

Environment Canada, Environmental Protection Service, *Air Pollution Emissions and Control Technology: Thermal Power Generation Industry, Volume 2, Particulate Emissions from Steam-Powered Stations*, Report EPS3-AP-79-6, March 1980.

Note:

This table illustrates the percentage by weight content determined by proximate analysis, of potentially

polluting substances in various types of coal. Ash content, for example, has an impact on particulate emissions and sulphur content on sulphur dioxide emissions. The heating value is also significant in this context as more of a low value coal must be burned to equal the heat content of a smaller amount of high value coal. Moreover, if low value coal contains relatively high proportions of potentially polluting substances the emission control problem is increased.



Source: Energy, Mines and Resources Canada, *The National Atlas of Canada, fifth edition, Electric Generation and Transmission Lines in Canada*, 1983.

Map 6.3.8
Nuclear Generating Stations in the St. Lawrence-Great Lakes Basin, 1984



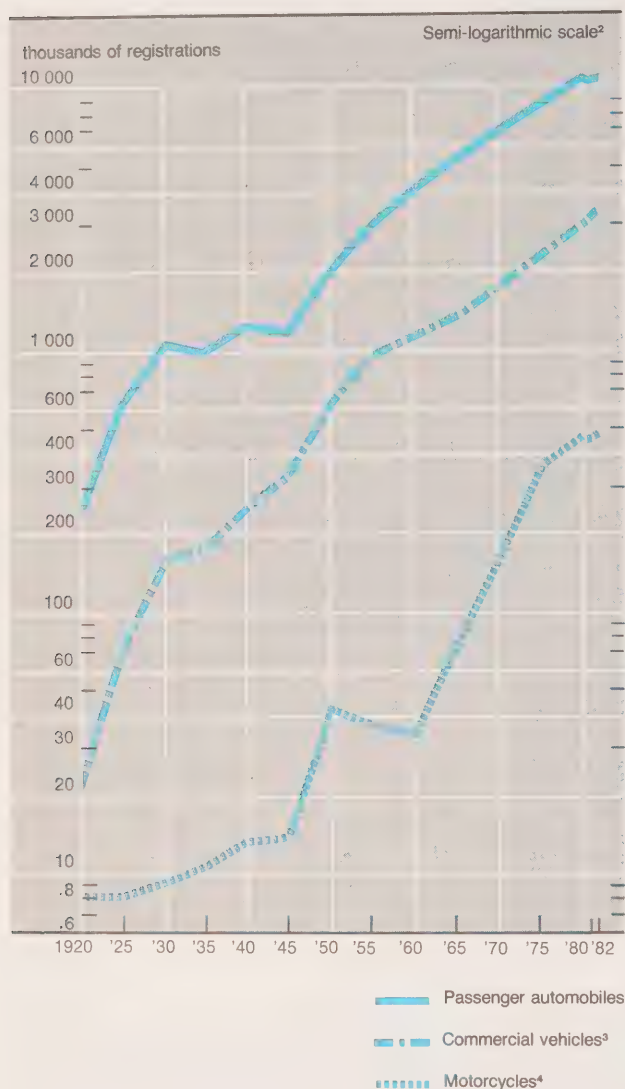
Sources:
Atomic Energy Control Board of Canada, Ottawa, 1984.
U.S. Nuclear Regulatory Commission, Washington.

6.4

Transportation Activity



Chart 6.4.1
Motor Vehicles¹, 1910 to 1982



¹ Road motor vehicle registrations.

² A semi-logarithmic scale is employed to allow comparison of rates of growth.

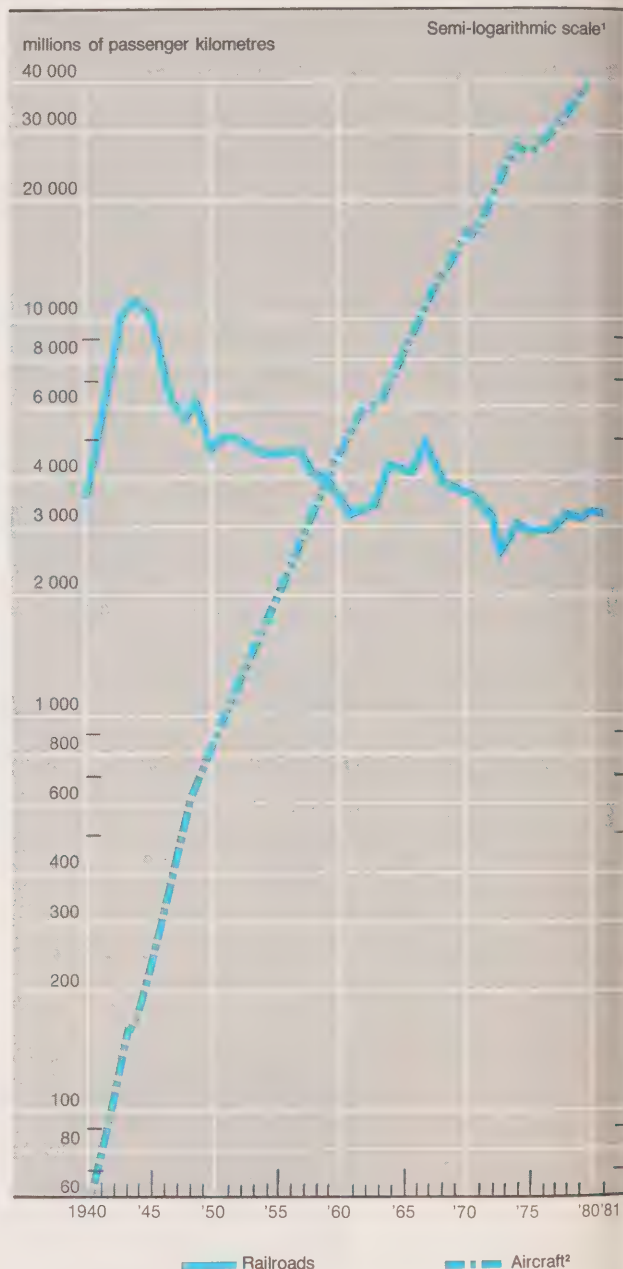
³ Includes buses, trucks, truck tractors, ambulances and other vehicles.

⁴ Includes mopeds.

Source:

Statistics Canada, *Road Motor Vehicles: Registrations*, Catalogue 53-219.

Chart 6.4.2
Railroad and Aircraft Passenger Kilometres,
1940 to 1981



Footnotes:

¹ A semi-logarithmic scale is employed to allow comparison of rates of growth.

² Includes all foreign and domestic services by Canadian carriers and that part of service by foreign carriers taking place over Canadian territory. Includes only unit toll operations. Unit toll is defined as the public transportation of persons and/or goods between designated points or from a designated base to a defined area at a fixed rate per unit.

Sources:

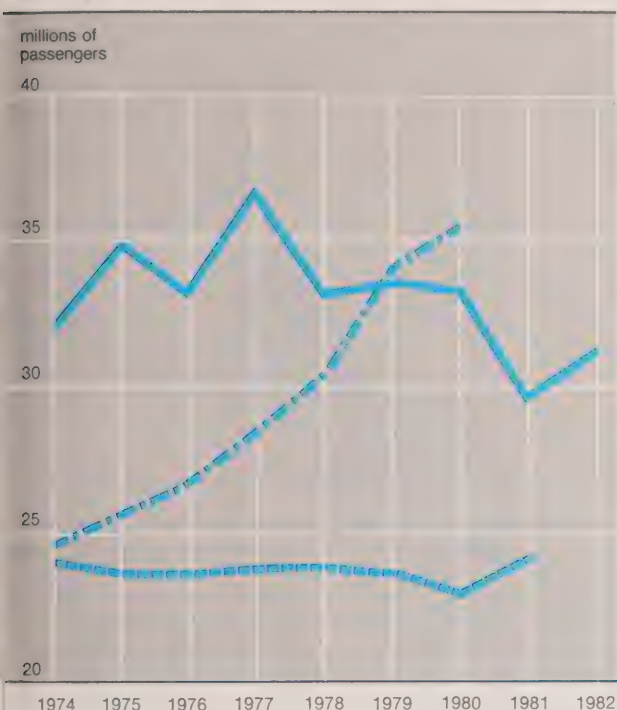
Statistics Canada, *Railway Transport, Part IV, Operating and Traffic Statistics*, Catalogue 52-210.

Statistics Canada, *Air Carrier Operations in Canada*, Catalogue 51-002.

Statistics Canada, *Civil Aviation*, Catalogue 51-202.

Statistics Canada, *Aviation in Canada (1971)*, Catalogue 51-501.

Chart 6.4.3
Passengers Carried by Transportation Mode, 1974 to 1982



¹ Includes all foreign and domestic services by Canadian carriers and that part of the foreign carriers' service taking place over Canadian territory.

² In 1974 includes only operations earning more than \$500,000 in gross revenue per year. Starting in 1975, includes operations earning more than \$100,000 in gross revenue per year.

Sources:

Statistics Canada, *Air Carrier Operations in Canada*, Catalogue 51-002.

Statistics Canada, *Passenger Bus and Urban Transit Statistics*, Catalogue 53-215.

Statistics Canada, *Railway Transport, Part 1, Comparative Summary Statistics*, Catalogue 52-207.

Table 6.4.4
Airport Activity: Aircraft Movements¹ by Weight Class, 1983

Airport ²	Weight Class ³				Total Movements
	Light	Medium	Heavy	Very Heavy	
Toronto International (Pearson)	58 412	27 600	116 241	33 214	235 467
Montreal International (Dorval)	51 323	23 024	65 999	8 746	149 092
Vancouver International	136 104	12 501	62 035	11 886	222 526
Calgary International	66 350	17 637	56 009	7 764	147 760
Winnipeg International	44 601	14 263	33 764	3 590	96 218
Edmonton International	21 612	3 861	32 848	4 094	62 415
Ottawa International	50 955	28 123	27 670	2 267	109 015
Halifax International	15 217	11 175	18 813	2 039	47 244
Mirabel International	9 485	5 118	3 247	16 453	34 303
Edmonton Municipal	105 329	9 890	12 698	13	127 930
Québec	53 786	8 142	12 228	274	74 430
Regina	41 043	3 172	9 968	363	54 546
Gander International	7 705	4 973	6 060	3 298	22 036
Saskatoon	39 393	5 045	9 053	216	53 707
Victoria International	81 840	3 522	8 722	117	94 251
St. John's	15 277	4 675	7 562	807	28 321

¹ A landing or a take-off by an aircraft. Includes only itinerant movement, one in which the aircraft enters or leaves the airport tower control zone.

² Airports are listed in descending order of volume of heavy and very heavy aircraft movements. (A crude indicator of airport noise disturbance, although this should be considered in context of location (see Table 6.4.5)).

³ The following are examples of aircraft for each weight class:

Light (less than 5 670 kgs.) Beechcraft Baron (2 322 kgs),
 Piper Navajo (3 538 kgs), DeHavilland
 of Canada DHC6 Twin Otter (5 760
 kgs).

Medium (5 671 - 35 000 kgs) McDonnell Douglas DC3/Dakota C47
 (11 431 kgs), DeHavilland of Canada
 DHC7 Dash-7 (19 505 kgs), British
 Aerospace 748 (21 092 kgs).

Heavy (35 001 - 136 000 kgs) Boeing 737 Passenger (50 350 kgs),
 McDonnell Douglas DC9-30 (54 885
 kgs), Boeing 727-200 (86 638 kgs).

Very Heavy (more than 136 000
 kgs) Boeing 767 (141 523 kgs), McDonnell
 Douglas DC8 (142 884 kgs),
 Aerospatiale-British Aerospace
 Concorde (181 440 kgs), Lockheed
 L1011 (195 048 kgs), McDonnell
 Douglas DC10 (206 388 kgs), Boeing
 747 Passenger (377 849 kgs).

Source:

Transport Canada, *Aircraft Movement Statistics, Annual Report*, TP-577, 1984.

Table 6.4.5
Estimated Population Affected by Aircraft Noise¹ Around Selected Airports, 1976

Noise Zone	Montreal (Dorval) International	Toronto (Pearson) International	Ottawa International	Edmonton Industrial
Lower Noise Zone ²	206 189	64 712	30 241	20 241
Intermediate Noise Zone ³	68 586	48 947	6 803	8 063
Upper Noise Zone ⁴	18 798	41 367	4 312	3 232
Total	293 573	155 026	41 356	31 549

¹ Noise contours are expressed in Noise Exposure Forecast (N.E.F.) units. This unit depends on the frequency of aircraft movements at a specific location and of each individual noise expressed in Effective Perceived Noise decibel (EPNdB) units, on a typical summer day. The EPNdB unit provides a frequency weighting system which approximates the subjective reaction of the human ear to noise stimulus weighted according to the disturbance elements of noise. In the N.E.F. calculations one movement during nighttime (between 22:00 and 07:00 hours) is equivalent to the annoyance level of 16 movements during daytime. It should be noted that there is not a one-to-one correspondence between the frequency of movements and N.E.F. units; for example, a 100 percent growth in traffic will result in an increase of just 3 N.E.F. units.

² In the "lower" noise zone, values range between N.E.F. 25 and 30.

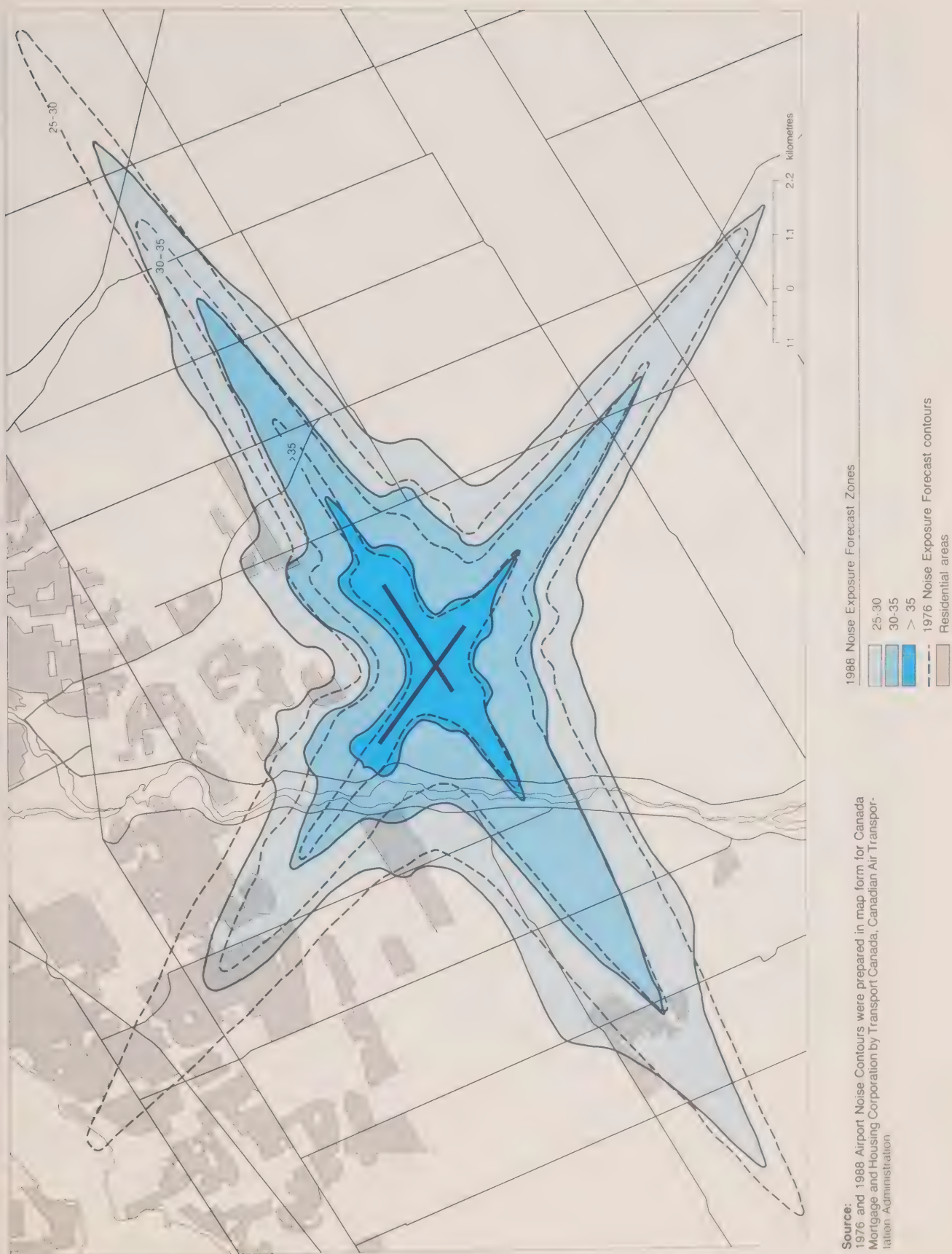
³ In the "intermediate" noise zone, values fall between N.E.F. 30 and 35.

⁴ In the "upper" noise zone, values are greater than N.E.F. 35.

Sources:

Statistics Canada, *1976 Census of Canada, Census Tracts*, Catalogue 95-811, 95-813, 95-803 and 95-826.

Transport Canada, Canadian Air Transportation Administration, Airport noise contour maps prepared for Canada Mortgage and Housing Corporation.



Source: 1976 and 1988 Airport Noise Contours were prepared in map form for Canada Mortgage and Housing Corporation by Transport Canada, Canadian Air Transportation Administration

Table 6.4.7
Cargo Movements Through Canadian Ports, 1935 to 1983

	Cargo Loaded and Unloaded			Vessel Arrivals and Departures		
	International Shipping ¹	Coastwise Shipping ²	Total	International Shipping ¹	Coastwise Shipping ²	Total
	thousands of tonnes					
1935	16 803	..	..	70 132	136 986	207 118
1940	25 195	..	..	93 653	156 278	249 931
1950 ³	52 137	..	..	64 923	166 289	231 212
1960	81 209	73 815	155 024	68 419	233 861	302 280
1965	123 299	96 458	219 757	57 912	195 211	253 123
1970	148 969	113 232	262 201	50 604	156 379	206 983
1975	166 221	108 745	274 966	40 522	93 742	134 264
1980	211 821	165 523	377 344	57 786	75 600	133 386
1982	174 011	131 763	305 744	49 206	57 376	106 582
1983	178 405	..	..	50 539	..	..

¹ International shipping includes trips that have one terminal point in Canada and the other in a foreign port.

² Domestic shipping includes trips that originate and terminate in Canadian ports.

³ Data for Newfoundland were included from April 1, 1949. Data for non-customs ports were included for the first time in 1957.

Sources:

Statistics Canada, *Shipping Report: Part II, International Seaborne Shipping*, Catalogue 54-203.

Statistics Canada, *Shipping Report: Part III, Coastwise Shipping*, Catalogue 54-204.

Statistics Canada, *International Seaborne Shipping, Port Statistics*, Catalogue 54-211.

Statistics Canada, *Coastwise Shipping Statistics*, Catalogue 54-210.

Table 6.4.8
Total Cargo and Petroleum Products Handled in Canadian Ports, 1981¹

Ports ²	Total Cargo ³	Petroleum Products ⁴	Petroleum Products as a Percentage of Total Cargo
	thousands of tonnes		percent
Atlantic Region			
Sept-Îles ⁵	28 636	783	2.7
Port Cartier	28 131	302	1.1
Montréal	21 107	6 650	31.5
Québec/Lévis	17 417	6 198	35.6
Saint John	14 201	11 112	78.3
Halifax	11 911	6 639	55.7
Baie-Comeau	8 129	321	4.0
Sorel	6 217	0	0.0
Contrecoeur	4 174	454	10.9
Port-Alfred	4 048	631	15.6
Port Hawkesbury	3 623	2 672	73.8
Trois-Rivières	2 526	357	14.1
Havre-St-Pierre	2 079	8	0.4
Sydney	1 833	383	20.9
Sub-total	154 032	36 511	23.7
Other ports	16 096	5 324	33.0
Total	170 128	41 835	24.6
Great Lakes Region			
Thunder Bay	19 623	477	2.4
Hamilton	10 445	299	2.9
Nanticoke	7 160	269	3.8
Sault Ste. Marie	6 230	519	8.3
Sarnia	6 065	3 520	58.0
Windsor	3 529	397	11.3
Toronto	1 948	239	12.3
Port Colborne	1 680	67	4.0
Sub-total	56 679	5 786	10.2
Other ports	17 948	1 600	8.9
Total	74 627	7 386	9.9

Ports ²	Total Cargo ³	Petroleum Products ⁴	Petroleum Products as a Percentage of Total Cargo
	thousands of tonnes		percent
Pacific Region			
Vancouver ⁶	52 945	2 471	4.7
North Arm, Fraser River	6 021	1	..
Howe Sound	5 401	8	0.2
New Westminster	5 170	36	0.7
Prince Rupert	2 873	168	5.9
Nanaimo	2 864	430	15.0
Jervis Inlet	2 565	8	0.3
Fraser River	2 117	1	0.1
Campbell River	1 991	103	5.2
Victoria	1 842	467	25.4
Kitimat	1 516	239	15.8
Port Alberni	1 135	59	5.2
Sub-total	84 893	3 991	4.7
Other ports	26 527	765	2.9
Total	111 420	4 775	4.3
Canada Total	356 175	53 976	15.2

¹ Ports listed are those with more than one million metric tonnes of cargo loaded and unloaded by domestic and international shipping.

² Ports are listed in descending order of total cargo handled in each region.

³ Total cargo handled includes crude petroleum and refined products.

⁴ Includes crude petroleum and refined products (gasoline, fuel oil, etc.).

⁵ Including Pointe-Noire.

⁶ Including Roberts Bank.

Sources:

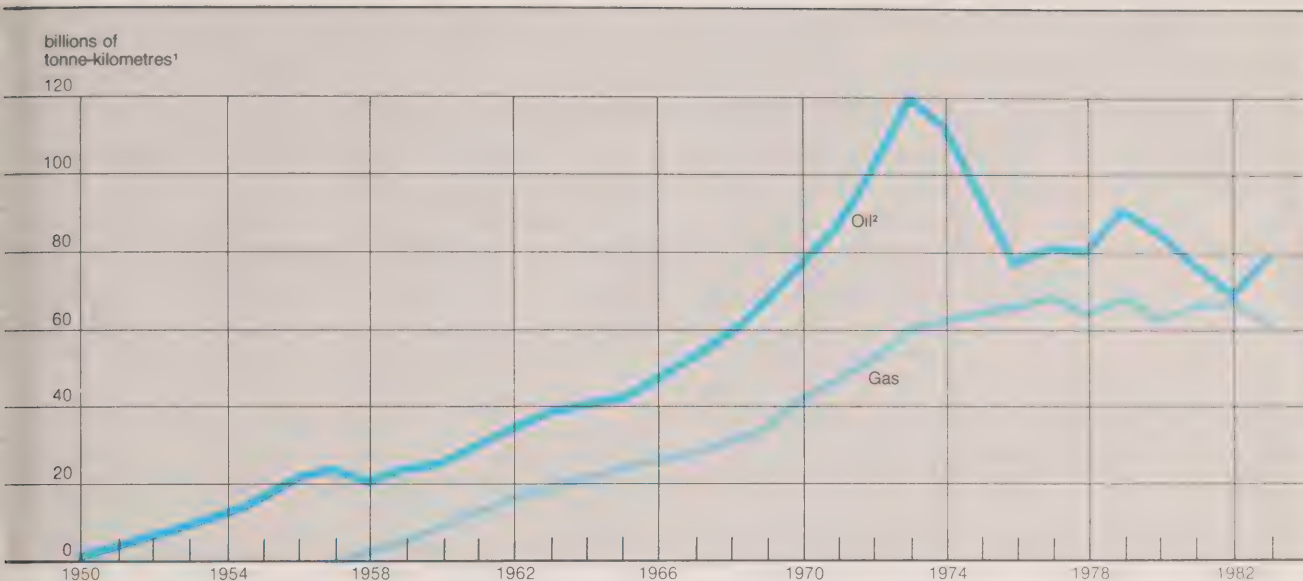
Statistics Canada, *Coastwise Shipping Statistics*, Catalogue 54-210.

Statistics Canada, *International Vessel Traffic Statistics*, Catalogue 54-209.

Note:

Individual items may not add to totals due to rounding.

Chart 6.4.9
Oil and Gas Movements by Pipelines, 1950 to 1983



¹ A tonne-kilometre is a unit which measures the movement of one tonne of a good one kilometre.

² Trunk lines only.

Sources:

Statistics Canada, *Gas Utilities: Transport and Distribution Systems*, Catalogue 57-205.

Statistics Canada, *Oil Pipeline Transport*, Catalogue 55-201.

Statistics Canada, *Historical Statistics of Canada*, second edition.

Table 6.4.10
Energy Consumed by Transportation Mode, 1958 to 1983

	Road	Rail	Air	Marine	Total
	terajoules				
1958	523 405	134 042	42 396	75 932	775 775
1960	570 758	82 365	47 247	85 951	786 321
1965	723 641	90 591	58 426	107 993	989 651
1970	970 773	89 642	102 720	111 473	1 274 608
1975	1 286 208	99 028	145 959	93 123	1 624 318
1980	1 461 438	94 209	138 660	150 662	1 844 969
1982	1 180 333	83 992	118 924	116 639	1 494 888
1983	1 152 174	79 334	116 382	89 171	1 437 061

Sources:

Statistics Canada, *Quarterly Report on Energy Supply-Demand in Canada*, Catalogue 57-003, for years 1980, 1982 and 1983.

Statistics Canada, *Detailed Energy Supply and Demand in Canada*, Catalogue 57-207, for years 1970 and 1975.

Statistics Canada, *Detailed Energy Supply and Demand in Canada, 1958-1969*, Catalogue 57-505.

Table 6.4.11
Gasoline Production and Lead Use, 1975 to 1983¹

Year	Gasoline Production			Lead Added to Gasoline	Lead Concentration ² in Leaded Gasoline	
	Leaded	Lead-free	Total			
	percent			millions of cubic metres ³	millions of kilograms	grams per litre
1975	94.3	5.7	100.0	35.39	15.8	0.47
1976	87.4	12.6	100.0	36.25	14.6	0.46
1977	81.8	18.2	100.0	36.55	13.1	0.44
1978	76.4	23.6	100.0	35.98	12.2	0.44
1979	67.8	32.2	100.0	37.30	11.9	0.47
1980	63.4	36.6	100.0	38.19	11.0	0.45
1981	61.5	38.5	100.0	37.04	10.5	0.46
1982	60.9	39.1	100.0	33.16	9.3	0.46
1983	58.3	41.7	100.0	33.49	8.7	0.44

¹ Lead-free and leaded gasoline regulations were introduced under the authority of the Clean Air Act in 1973 and 1974 in response to health concerns regarding the effects of lead. In order to monitor lead use in gasoline, the regulations specify that each refinery must report the quantity of gasoline produced and the amount of lead added to it to Environment Canada.

² Recent medical research indicates that lead contamination continues to be a cause for concern, that children are particularly at risk and that lead additives in gasoline contribute substantially to the risks involved. Therefore a new measure to reduce lead content of gasoline was announced by Environment Canada in 1984. It will become effective on January 1st, 1987 and will reduce the lead content from 0.77 grams per litre to 0.29 grams per litre. This will bring about an 80 percent reduction in automobile lead emissions from the 1972 level.

³ One cubic metre is 1,000 litres.

Sources:

Environment Canada, Environmental Protection Service, unpublished information.

Environment Canada, Environmental Protection Service, *Lead-Free and Leaded Gasoline Enforcement Programs, 1974-80*, Report EPS 3-AP-82-3, 1982.

House of Commons Canada, Sub-Committee on Acid Rain, *Time Lost, A Demand for Action on Acid Rain*, 1984.

Environment Canada, Environmental Protection Service, *The Phase-down of Lead in Gasoline*, Report EPS 2/CC/1, August 1984.

6.5

Household Consumption and Municipal Wastes



Table 6.5.1
Population Served by Municipal Wastewater Treatment Systems, by Major Drainage Area¹

Major Drainage Area	Municipal Population Served by Wastewater Treatment Systems					Municipal Population	Percent of Municipal Population Served
	Primary ²	Secondary ³	Lagoons ⁴	Other ⁵	Total		
Atlantic Ocean Basin	1 236 822	5 545 619	472 106	71 898	7 326 445	15 507 772	47.2
Atlantic Ocean Coastal	1 200	66 696	1 200	4 856	73 952	644 404	11.5
Gulf of St. Lawrence Coastal	37 474	133 727	71 836	19 637	262 674	819 537	32.1
Bay of Fundy Coastal and Saint John River	0	134 866	72 823	6 564	214 253	435 335	49.2
St. Lawrence River	199 178	187 621	46 590	13 579	446 968	5 810 222	7.7
Ottawa River	433 835	82 826	48 338	10 442	575 441	1 117 713	51.5
Lake Ontario Shore	153 741	3 650 836	69 938	922	3 875 437	4 253 909	91.1
Lake Erie and Lake St. Clair Shore	228 677	949 935	82 797	13 012	1 274 421	1 553 872	82.0
Lake Huron Shore	123 423	339 112	74 164	1 320	538 019	740 623	72.6
Lake Superior Shore	59 294	0	4 420	1 566	65 280	132 157	49.4
Hudson Bay and Ungava Bay Basin	331 346	1 744 826	789 347	8 931	2 874 450	3 203 121	89.7
Hudson Bay and Ungava Bay Coastal	28 204	37 699	29 041	3 694	98 638	225 784	43.7
Nelson River	14 000	2 675	7 508	1 300	25 483	25 924	98.3
Lake Winnipeg Shore	9 000	612 202	87 701	0	708 903	745 449	95.1
Assiniboine River	0	68 159	297 121	0	365 280	374 302	97.6
Saskatchewan River	280 142	1 024 091	367 976	3 937	1 676 146	1 831 662	91.5
Arctic Ocean Basin	0	4 256	155 694	5 115	165 065	179 464	92.0
Mackenzie River	0	4 256	154 338	5 115	163 709	173 963	94.1
Arctic Ocean Coastal	0	0	1 356	0	1 356	5 501	24.7
Pacific Ocean Basin	206 585	332 943	151 096	218 709	909 333	1 989 529	45.7
Columbia River	29 435	91 873	45 650	0	166 958	223 475	74.7
Fraser River	1 550	178 277	30 050	15 573	225 450	1 181 516	19.1
Yukon River	0	160	17 150	800	18 110	20 629	87.8
Pacific Ocean, North Coastal	10 000	8 030	15 950	0	33 980	56 280	60.4
Pacific Ocean, South Coastal	165 600	54 603	42 296	202 336	464 835	507 629	91.6
Gulf of Mexico Basin	0	0	3 216	0	3 216	3 280	98.0
Missouri River	0	0	3 216	0	3 216	3 280	98.0
Canada	1 774 753	7 627 644	1 571 459	304 653	11 278 509	20 883 166	54.0

¹ Data obtained from MUNDAT (a national inventory of waterworks and wastewater systems in Canada). The updating of the information occurs on a continuous basis, as received from participating agencies. Frequency of updating and completeness of replies varies among the respondents. The data presented here are current as of May 1984.

² Primary systems include systems that depend on physical or mechanical unit operations (e.g. bar screen, grit removal, sedimentation tank) as the sole component for removing settleable and floating solids.

³ Secondary systems include mechanical plants having aerobic biological treatment processes (use of naturally occurring bacteria in sewage) and secondary clarifiers.

⁴ Lagoons are man-made pools where natural waste decomposition occurs through contact with the air and naturally occurring micro-organisms, and through the settling of solids.

⁵ Other types of treatment systems which are not specified (e.g. comminution only, grit removal only).

⁶ Current municipal population as reported to MUNDAT. This represents about eighty-six percent of the total population of Canada (1981 Census). Much of the remaining population lives in rural areas and for the most part is serviced by private waste treatment and disposal systems such as septic tanks and tile fields. Population figures shown for certain drainage basins may be inconsistent with 1981 Census figures. These discrepancies may be the result of the following types of errors: non-inclusion or double counting of populated areas, variations in respondents interpretation of the survey questions, variations in the completeness and reliability of information available to respondents, processing of data.

Source:

Environment Canada, Environmental Protection Service, special tabulation from the MUNDAT database.

Table 6.5.2
Estimated Daily Waste Discharged from Municipalities by Major Drainage Area¹

Major Drainage Area	Waste Generated ²			Waste Removed ³			Waste Discharged		
	BOD ₅	Suspended Solids	Phosphorus	BOD ₅	Suspended Solids	Phosphorus	BOD ₅	Suspended Solids	Phosphorus
	kilograms per day			percentage			kilograms per day		
Atlantic Ocean Basin	2 199 680	1 977 705	70 366	32.4	40.9	40.6	1 487 478	1 169 786	41 793
Atlantic Ocean Coastal	92 966	83 668	2 972	8.7	11.7	4.0	84 876	73 911	2 853
Gulf of St. Lawrence Coastal	101 975	91 777	3 257	16.4	18.7	7.7	92 757	74 599	3 006
Bay of Fundy Coastal and									
Saint John River	49 735	44 761	1 589	29.1	31.0	13.7	35 260	30 874	1 371
St. Lawrence River	817 471	735 721	26 155	4.6	6.6	8.2	779 848	686 996	24 002
Ottawa River	168 540	151 685	5 392	21.8	54.4	51.2	131 865	69 148	2 633
Lake Ontario Shore	600 922	540 831	19 227	68.0	77.6	77.1	192 529	120 915	4 394
Lake Erie and Lake St. Clair									
Shore	246 698	222 028	7 892	56.9	68.2	71.3	106 208	70 686	2 267
Lake Huron Shore	107 947	97 151	3 453	49.1	59.9	66.5	54 942	39 001	1 157
Lake Superior Shore	13 426	10 083	429	31.5	63.7	74.4	9 193	3 656	110
Judson Bay and Ungava Bay Basin	389 447	350 498	12 450	65.9	75.8	27.7	132 722	84 897	8 997
Judson Bay and Ungava Bay									
Coastal	29 929	26 935	953	26.0	31.7	10.7	22 147	18 402	851
Jelson River	2 374	2 137	75	47.6	63.8	18.7	1 244	774	61
Lake Winnipeg Shore	90 872	81 783	2 905	75.0	83.8	33.1	22 754	13 279	1 943
Assiniboine River	30 284	27 255	968	83.5	74.9	31.7	4 994	6 828	661
Saskatchewan River	235 988	212 388	7 549	65.4	78.5	27.4	81 583	45 614	5 481
Arctic Ocean Basin	14 984	13 464	472	72.8	60.8	27.8	4 083	5 272	341
MacKenzie River	14 196	12 775	450	76.3	63.9	28.9	3 370	4 618	320
Arctic Ocean Coastal	788	709	22	9.5	7.8	4.5	713	654	21
Pacific Ocean Basin	161 134	145 018	5 149	25.6	30.7	13.9	119 943	100 484	4 433
Columbia River	22 243	20 018	710	47.3	52.8	31.3	11 713	9 450	488
Fraser River	46 834	42 151	1 497	25.7	28.3	19.4	34 806	30 219	1 207
Kukon River	4 802	4 322	153	81.0	67.5	28.1	913	1 403	110
Pacific Ocean, North Coastal	8 006	7 204	254	45.3	45.1	16.1	4 382	3 954	213
Pacific Ocean, South Coastal	79 249	71 323	2 535	14.0	22.2	4.7	68 129	55 456	2 415
Gulf of Mexico Basin	206	185	6	86.9	72.4	33.3	27	51	4
Missouri River	206	185	6	86.9	72.4	33.3	27	51	4
Canada	2 765 451	2 486 870	88 443	37.2	45.3	37.2	1 744 253	1 360 488	55 568

Data obtained from MUNDAT (a national inventory of waterworks and wastewater systems in Canada). The updating of the information occurs on a continuous basis, as received from participating agencies. The data presented here are current as of May 1984.

Discharged coefficients were applied to the average daily wastewater received by sewage collection systems. These were 0.25 kilograms per cubic metre for Biochemical Oxygen Demand (BOD₅), 0.225 kilograms per cubic metre for suspended solids and 0.008 kilograms per cubic metre for phosphorus. This assumes the composition of wastewater is identical across Canada. For residential, commercial and institutional sectors this may be valid, however this may not be the case for industrial wastewater.

³ "Waste removed", shown here is from the wastewater undergoing primary, secondary and lagoon treatment. In calculating the amount of waste removed by treatment, standard waste removal efficiencies coefficients were used, i.e. primary treatment: 25 percent BOD₅ removal, 60 percent suspended solids removal and 5 percent phosphorus removal; secondary treatment: 80 percent BOD₅ removal, 90 percent suspended solids removal and 35 percent phosphorus removal; lagoon treatment: 90 percent BOD₅ removal, 75 percent suspended solids removal and 30 percent phosphorus removal. The untreated proportion of wastewater has also been considered in this calculation.

Source:

Environment Canada, Environmental Protection Service, MUNDAT database, special tabulation.

Table 6.5.3
Private Occupied Dwellings by Principal House Heating Fuel, by Ecozone, 1981¹

Ecozone	Oil	Gas ²	Electricity	Wood	Other ³	Total Private Occupied Dwellings
percent of private occupied dwellings						
Atlantic Maritime	63.9	0.7	22.1	12.5	0.8	629 235
Prince Edward Island	79.0	0.3	2.8	17.7	0.2	37 655
Nova Scotia	75.2	1.1	11.2	10.8	1.7	273 190
New Brunswick	59.9	0.4	24.3	15.2	0.2	214 795
Québec	36.7	0.4	53.4	9.5	0.1	103 585
Mixed-Wood Plain	38.0	32.7	27.2	1.9	0.2	4 482 340
Québec	47.8	8.0	42.1	2.0	0.1	1 809 630
Ontario	31.3	49.4	17.2	1.9	0.2	2 672 700
Boreal Shield	40.3	13.9	35.8	9.9	0.2	709 575
Newfoundland	50.7	0.1	34.4	14.4	0.5	141 110
New Brunswick	56.0	0.0	36.0	8.0	0.0	125
Québec	40.0	2.0	51.3	6.6	0.1	255 200
Ontario	35.9	30.9	23.0	10.1	0.2	295 940
Manitoba	31.4	11.5	40.2	16.5	0.5	14 415
Saskatchewan	45.8	6.9	19.0	27.3	1.1	2 770
Prairie	8.1	79.4	11.1	0.8	0.5	1 249 330
Manitoba	13.6	60.6	23.7	1.7	0.4	313 330
Saskatchewan	17.2	74.2	7.0	1.2	0.5	286 280
Alberta	1.5	90.8	6.9	0.2	0.6	649 735
Boreal Plain	19.9	59.7	10.8	8.5	1.2	188 670
Manitoba	32.8	12.1	37.3	17.1	0.7	29 455
Saskatchewan	29.7	50.6	7.4	11.3	1.0	42 865
Alberta	12.5	76.7	4.4	4.8	1.6	99 280
British Columbia	14.9	66.8	10.4	7.5	0.5	16 680
Yukon	67.1	3.8	5.1	22.8	1.3	395
Montane Cordillera	21.9	43.5	23.8	10.5	0.3	239 935
Alberta	2.7	89.7	6.3	1.0	0.2	9 070
British Columbia	22.7	41.7	24.5	10.9	0.3	230 865
Pacific Maritime	26.6	47.2	22.7	3.2	0.3	747 655
British Columbia	26.6	47.2	22.7	3.2	0.3	747 655
Boreal Cordillera	61.1	3.9	15.9	18.4	0.7	8 245
British Columbia	46.2	17.0	4.7	30.8	1.2	1 265
Yukon	63.8	1.5	17.9	16.1	0.6	6 975
Tundra Cordillera	55.7	4.9	4.9	34.4	0.0	305
Yukon	51.1	4.4	4.4	40.0	0.0	225
Northwest Territories	68.8	18.8	0.0	12.5	0.0	80
Taiga Plain	64.1	9.5	5.0	20.1	1.4	3 910
Alberta	22.6	22.6	3.2	51.6	0.0	155
British Columbia	14.3	48.6	5.7	31.4	0.0	175
Northwest Territories	68.4	7.0	5.0	18.2	1.4	3 580
Taiga Shield	64.5	1.5	26.2	7.1	0.7	14 890
Newfoundland	65.6	0.0	23.1	10.5	0.9	6 875
Québec	44.6	0.7	54.6	0.1	0.0	3 680
Manitoba	2.6	0.0	2.6	94.9	0.0	195
Saskatchewan	90.1	1.9	5.6	0.0	2.5	805
Northwest Territories	81.5	5.7	7.9	4.3	0.6	3 345
Hudson Bay Plain	44.0	15.1	12.8	27.9	0.2	2 115
Québec	57.9	0.0	36.8	5.3	0.0	190
Ontario	46.3	2.2	6.2	44.9	0.4	1 135
Manitoba	17.6	48.7	21.8	11.8	0.0	595
Northwest Territories	100.0	0.0	0.0	0.0	0.0	195
Southern Arctic	88.4	0.5	5.5	5.0	0.6	3 110
Newfoundland	65.2	0.0	2.2	32.6	0.0	445
Québec	95.8	0.0	4.2	0.0	0.0	355
Northwest Territories	92.0	0.4	6.3	0.7	0.7	2 305
Northern Arctic	93.7	0.0	4.4	0.2	1.7	2 060
Québec	86.0	0.0	14.0	0.0	0.0	215
Northwest Territories	94.1	0.3	3.2	0.3	2.2	1 855
Arctic Cordillera	91.4	0.0	0.0	0.0	8.6	175
Northwest Territories	91.4	0.0	0.0	0.0	8.6	175
Canada	33.8	37.8	24.2	3.8	0.3	8 281 530

¹ The 1981 Census figures have been random rounded. Since they have been rounded independently, individual items may not add exactly to totals.

² Bottled gas (e.g. propane) and piped gas (e.g. natural gas).

³ Coal or coke and other fuel.

Source:

Special tabulation by the Census Operations Division, Statistics Canada, 1981 Census of Population.

Technical Box 6.5.4

Major Air Contaminant Emissions from Residential Heating¹, 1980

Contaminant	Tonnes	Residential Emissions as a Percentage of Emissions from All Sources
Particulates	93 858	0.2
Sulphur Oxides	70 023	1.5
Nitrogen Oxides	50 066	2.6
Hydrocarbons	9 488	0.3
Carbon Monoxide	412 710	2.2

¹ Includes fuelwood combustion**Source:**Environment Canada, Environment Protection Service, *Emissions and Trends of Common Air Contaminants in Canada (1970-1980)*, unpublished.**Note:**

Despite the relatively small volume of emissions from domestic heating sources, they impose a degree of stress on the human environment that is not proportional to their contribution to air pollution. First, the emissions are concentrated largely in winter months. Secondly, approximately eighty percent of domestic heating is located in densely populated urban areas. Thirdly, emissions are from low elevation chimneys, operating on natural draft with low exit velocities. This results in stack downwash and accumulation of pollutants in building cavities made worse by the weak dispersal action of wind at ground level. (Environment Canada, *Air Pollution Emissions and Control Technique: Residential Heating Units*, Report EPS 3-AP-79-3.)

Table 6.5.5
High Energy Consuming Household and Recreational Goods, 1960 to 1984

Year	Household Goods					Recreational Goods			Number of Households
	Clothes Dryers		Air Conditioners		Dishwashers	Outboard Motor Boats	Snowmobiles		
	Electric	Gas	Window	Central			One	Two or More	
percent of households owning									thousands
1960	11.4	0.7	..	..	..	..	..	..	4 404
1961	13.7	0.9	..	..	1.5	..	..	..	4 489
1962	17.3	1.2	1.7	..	1.7	..	..	..	4 592
1963	20.0	1.6	1.9	..	2.1	..	..	..	4 671
1964	22.2	1.7	2.1	..	2.2	..	..	..	4 872
1965	25.2	2.2	2.2	..	2.7	..	..	..	5 000
1966	27.4	2.6	2.6	..	3.2	..	..	..	5 126
1967	31.7	2.7	3.2	..	4.4	..	..	..	5 293
1968	33.9	2.9	3.2	..	5.1	..	..	..	5 458
1969	37.3	3.2	3.9	..	6.5	..	..	..	5 616
1970	40.8	3.5	4.3	..	7.5	..	..	..	5 784
1971	40.7	3.4	5.3	..	8.6	..	..	1.1	5 933
1972	39.4	3.5	5.8	..	9.2	..	6.7	1.6	6 111
1973	41.7	3.4	6.6	..	10.7	..	7.3	1.8	6 301
1974	44.6	3.7	7.6	2.5	12.9	8.6	7.1	2.1	6 513
1975	48.1	3.6	9.2	3.2	15.2	..	7.4	2.6	6 721
1976	51.3	3.4	9.6	3.7	18.7	8.0	7.1	2.7	6 949
1977	53.2	3.7	10.9	4.4	21.8	..	7.5	2.6	7 157
1978	56.0	3.4	10.7	4.5	23.9	7.9	7.1	2.6	7 357
1979	56.8	3.2	11.5	5.0	26.3	..	..	..	7 572
1980	59.9	3.2	11.4	5.3	28.6	7.8	7.2	2.5	7 787
1981	60.4	3.5	11.1	5.7	31.3	..	..	..	8 026
1982	62.5	3.7	9.9	6.1	33.3	7.6	6.3	2.2	8 254
1983	62.4	3.4	10.0	7.0	34.1	..	..	..	8 460
1984	64.2	3.1	9.1	7.5	35.2	..	..	..	8 857

Source:
Statistics Canada, *Household Facilities and Equipment*, Catalogue 64-202.

6.6

Multiple Source Stress



Technical Box 6.6.1

Energy Intensity of Industrial Processes: an Indicator of Environmental Stress

Energy intensity is a measure of the ratio of energy input to some other constant in the production process, such as energy per unit of output. The data in Table A depict the joule equivalent of purchased fuel and electricity by industrial group and per establishment (i.e., scale of production), per employee (i.e., energy/labour ratio) and per value added (i.e., energy/output ratio). These data are shown at a high level of aggregation and provide a rough indicator of the relative magnitude of energy throughput in industrial processes. Moreover, purchased energy accounts for a part of the energy consumption. In some high stressor industries energy needs are supplemented (or in some cases wholly supplied) through "self-produced" sources. Table B provides estimates of "self-produced energy" and compares this to purchased energy. Certain industrial activities are tied to cheap energy sources (e.g., aluminum production) whereas others generate (combustible) wastes from which they can obtain heat/steam (e.g., chemical and chemical products). Table C provides a further breakdown of "self-produced energy" into electricity and other energy sources. In 1981 the high stressor type manufacturing produced about forty-three percent of their own energy needs compared to three percent for all the remaining manufacturing industries.

From an environmental perspective all industrial processes can be reduced to a few basic physical and chemical transformations (i.e., concentration, mixing, synthesizing, shaping, assembling, and packaging). Energy consumption is an important element of all

these transformations and therefore is perhaps the most integrative parameter to assess the overall environmental impact of human actions. Nonetheless, one must take care in assigning a one-to-one correspondence between the level of energy intensity and the level of environmental impact. In the first instance the source of energy is of critical importance, for example, whether it is obtained from a renewable or non-renewable source. Secondly, the pathway of energy flow can have varying impacts on the environment beginning with its extraction/generation, its means of transport, its efficiency of consumption, and its final diffusion in the environment.¹ A further extension of the flow concept is to look at the "embodied energy" in the commodities produced. In Canada, the predominant exports tend to be of high energy content particularly when compared to imported goods, suggesting a net-outflow of energy. Thirdly, we may consider the complex question of energy conservation not only in the direct sense of more efficient use of energy in production but also in its indirect manifestations. Here we might consider the effect of a product's design (e.g., introduction of lighter materials in transport equipment) or built-in potential for recyclability (e.g., aluminum cans).

¹ Energy wastes are generally associated with diffusion in the atmosphere of waste residuals from combustion (e.g., particulates SO₂, CO₂, NO₂). However, also included here are waste heat generated from plant cooling and noise which is also a waste product.

Table A:
Energy Intensities in the Mineral and Manufacturing Industries, 1976 and 1981

Industrial Group	Energy Consumption of Fuel and Electricity ¹		Energy Consumed per Establishment ²		Energy Consumed per Employee ³		Energy Consumed per Millions of Dollars of Value Added in Constant 1971 Dollars ⁴	
	1976	1981	1976	1981	1976	1981	1976	1981
	petajoules		terajoules		terajoules		terajoules	
Mineral Industries	183.2	177.5	147	130	1.6	1.4	56	55
Iron Mines	73.1	50.8	4 063	3 625	4.4	4.1	263	349
Other Metal Mines	45.0	51.6	455	453	0.9	0.9	45	58
Asbestos Mines	12.6	9.9	1 053	1 105	1.6	1.5	106	136
Coal Mines	8.9	13.5	328	501	1.0	1.2	77	82
Other	43.5	51.7	40	43	1.4	1.1	25	27
Manufacturing Industries	1 434.4	1 504.1	49	42	0.8	0.8	61	58
Pulp and Paper	352.5	329.9	2 398	2 291	4.1	3.8	289	237
Iron and Steel ⁵	300.0	298.1	6 522	5 625	5.8	5.3	344	312
Smelting and Refining	92.9	99.8	3 318	3 023	2.7	2.6	211	176
Cement	62.3	52.1	2 306	1 930	13.8	11.0	462	416
Petroleum Refineries	40.2	58.1	1 032	1 453	2.7	2.7	135	229
Industrial Chemicals	140.0	189.2	979	1 261	6.4	7.1	370	409
Other	446.5	476.9	16	13	0.3	0.3	22	21

¹ Data include purchased fuel and electricity and exclude any self-produced fuel and electricity, fuel used for non-fuel purposes (production processes) and other energy sources such as steam or wood. Note that the coverage is incomplete. Figures apply only to larger establishments reporting detail in their operations.

² The establishment is defined as the smallest operating unit capable of

reporting a specified range of basic industrial statistics.

³ Includes production and related workers in mining or manufacturing operations and administrative, office and other employees.

⁴ The value added is the contribution of each industrial group to the gross domestic product.

⁵ Includes coal used as materials and supplies.

Technical Box 6.6.1

Energy Intensity of Industrial Processes: an Indicator of Environmental Stress

Table A (concluded)

Sources:		Statistics Canada, <i>Manufacturing Industries of Canada: National and Provincial</i> , Catalogue 31-203.
Energy, Mines and Resources Canada, Annual Census of Metal Mines, Non-Metal Mines and Sand Pits and Quarries, 1976 and 1981.		Statistics Canada, <i>Gross Domestic Product by Industry</i> , Catalogue 61-213.
Statistics Canada, Annual Census of Coal Mines and Annual Census of Manufactures, 1976 and 1981.		Statistics Canada, special tabulations by the Office of the Senior Adviser on Integration.
Statistics Canada, <i>General Review of Mineral Industries, Mines, Quarries and Oil Wells</i> , Catalogue 26-201.		

Table B
Comparison of Self-Produced Energy and Purchased Energy, Manufacturing Industries, 1981

Manufacturing Industry	Self-Produced Energy ¹	Purchased Energy	Total Energy	Self Produced Energy as a Percentage of Total Energy Used	Total Energy per Establishment
	petajoules			percent	terajoules
Pulp and Paper	275	330	605	45.5	4 201
Iron and Steel	2	298 ²	300	0.7	5 660
Smelting and Refining	109	100	209	52.2	6 333
Cement	0	52	52	0.0	1 930
Petroleum Refineries	261	58	319	81.8	7 975
Industrial Chemicals	124	189	313	39.6	2 087
All Other Manufacturing Industries	15	477	492	3.0	14
Total All Manufacturing Industries	786	1 504	2 290	34.4	64

¹ Includes self-produced electricity generated from woodwastes, liquors and other combustible by-products.

² Includes coal used as materials and supplies.

Sources:

Environment Canada, *Energy Supply and Use in the Canadian Domestic Market, 1971-1981*, by T.L. de Fayer and D. Piekarz, unpublished document, 1983.

Statistics Canada, Annual Census of Manufactures, 1981, special tabulation by the Office of the Senior Adviser on Integration.

Table C
Self-Produced Energy, 1980

Industrial Group	Self Generated Electricity	Refinery ¹ By-products	Black Liquor	Wood Waste	Purchased Steam	Other ²	Total
	petajoules						
Manufacturing Industries	139	281	279	89	77	211	1 077
Pulp and Paper	37	0	279	85	5	0	406
Iron and Steel	1	0	0	0	0	189	190
Smelting and Refining	89	0	0	0	0	22	111
Petroleum Refineries	--	238	0	0	2	0	241
Industrial Chemicals	7	42	0	0	69	0	119
Other	5	0	0	4	1	--	10
Other Industries³	3	0	0	0	0	0	3
Total Industries	143	281	279	89	77	211	1 080

¹ Includes own manufactured by-products, petroleum coke and still gas.

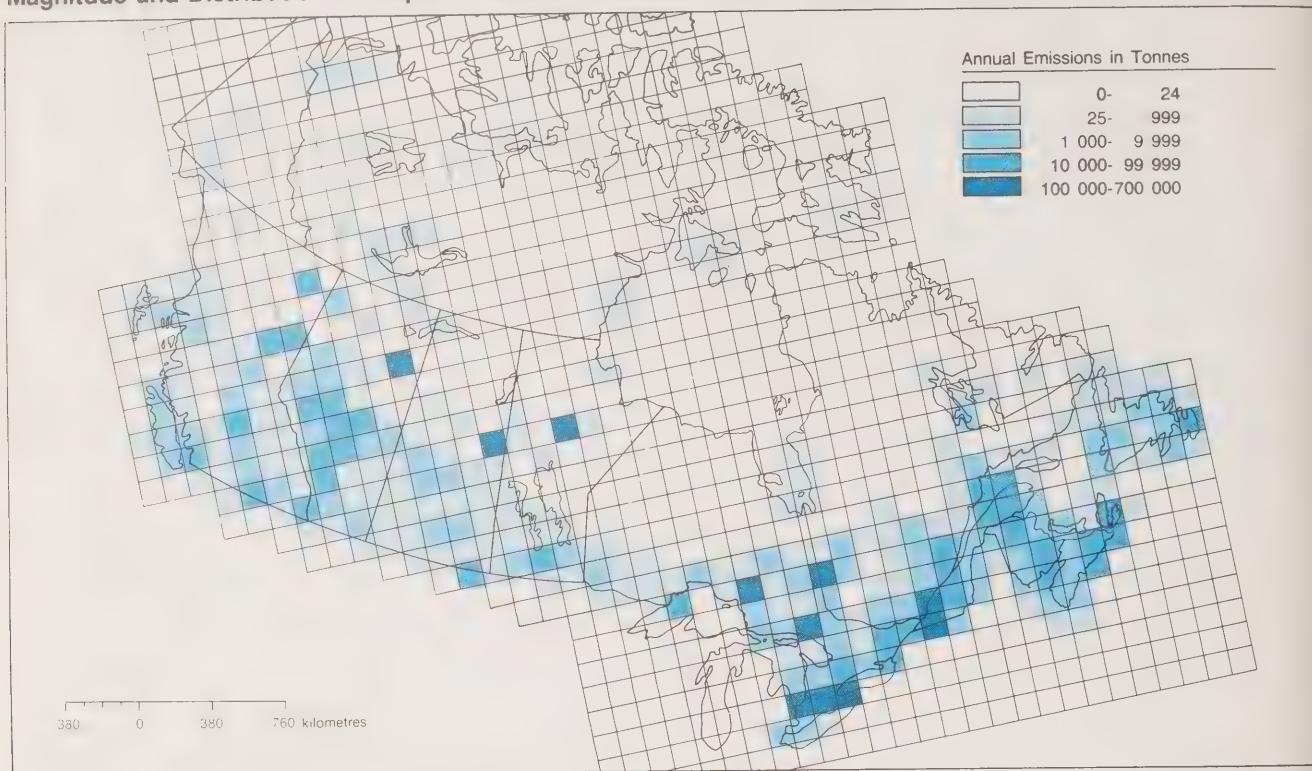
² Includes carbon electrodes and coal for coke and coke oven gas.

³ Includes logging and mining.

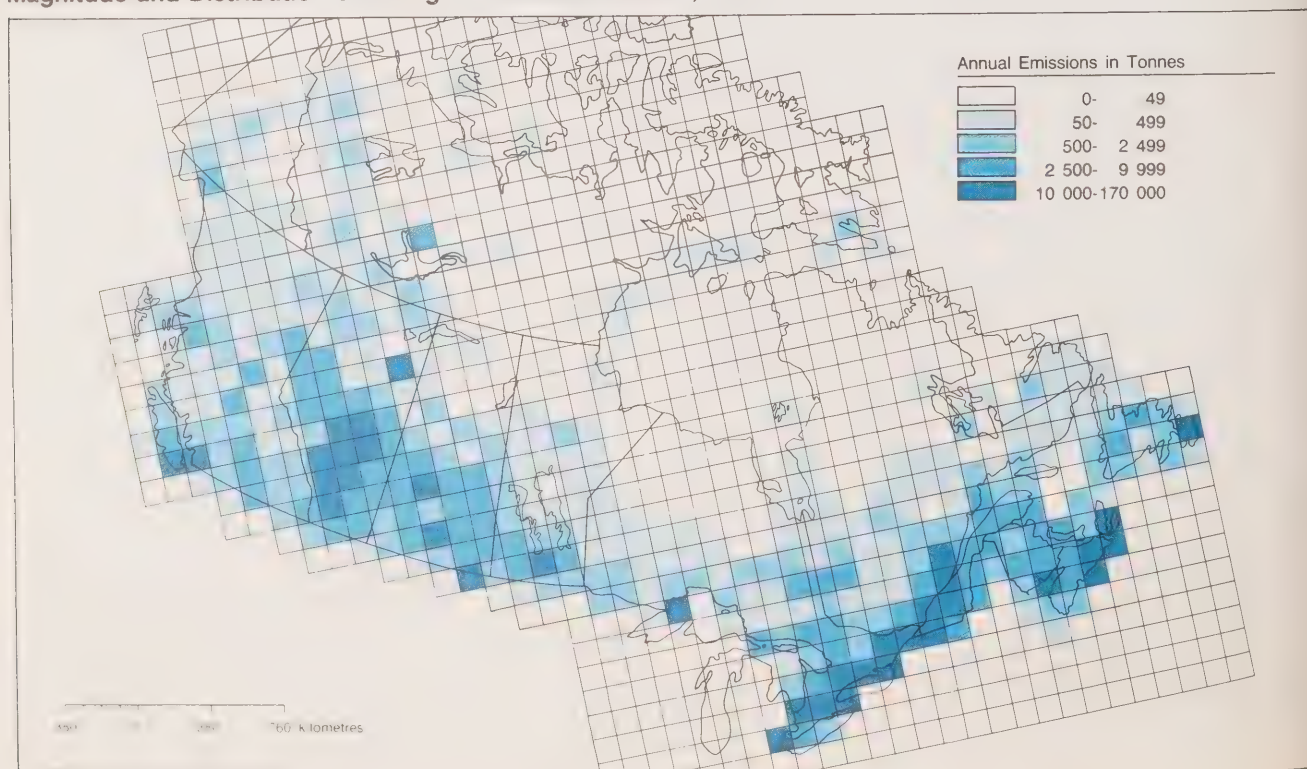
Source:

Energy, Mines and Resources Canada, Energy Conservation and Oil Substitution Branch, *Energy Cascading Potential in Canadian Industry, Data Base for 1980*, Industry Series, Publication Number 3b, February 1984.

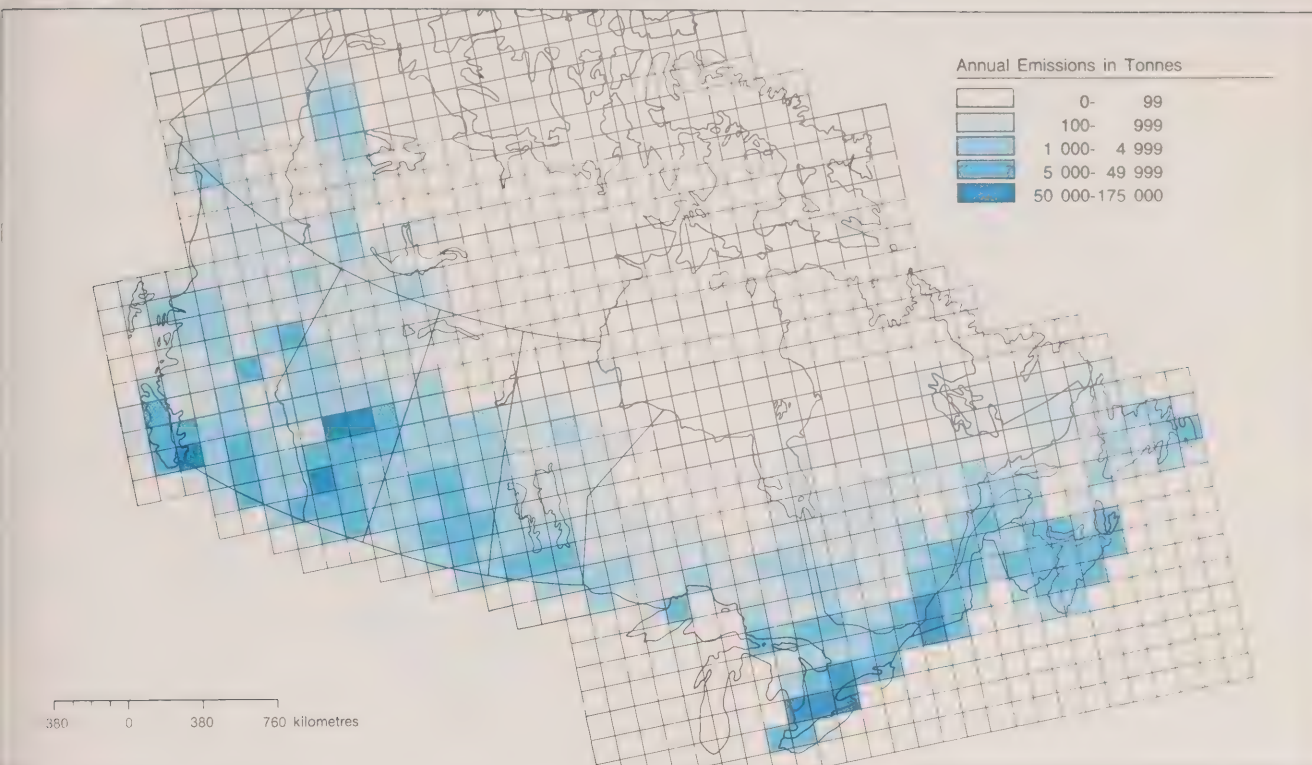
Map 6.6.2
Magnitude and Distribution of Sulphur Dioxide Emissions, 1978



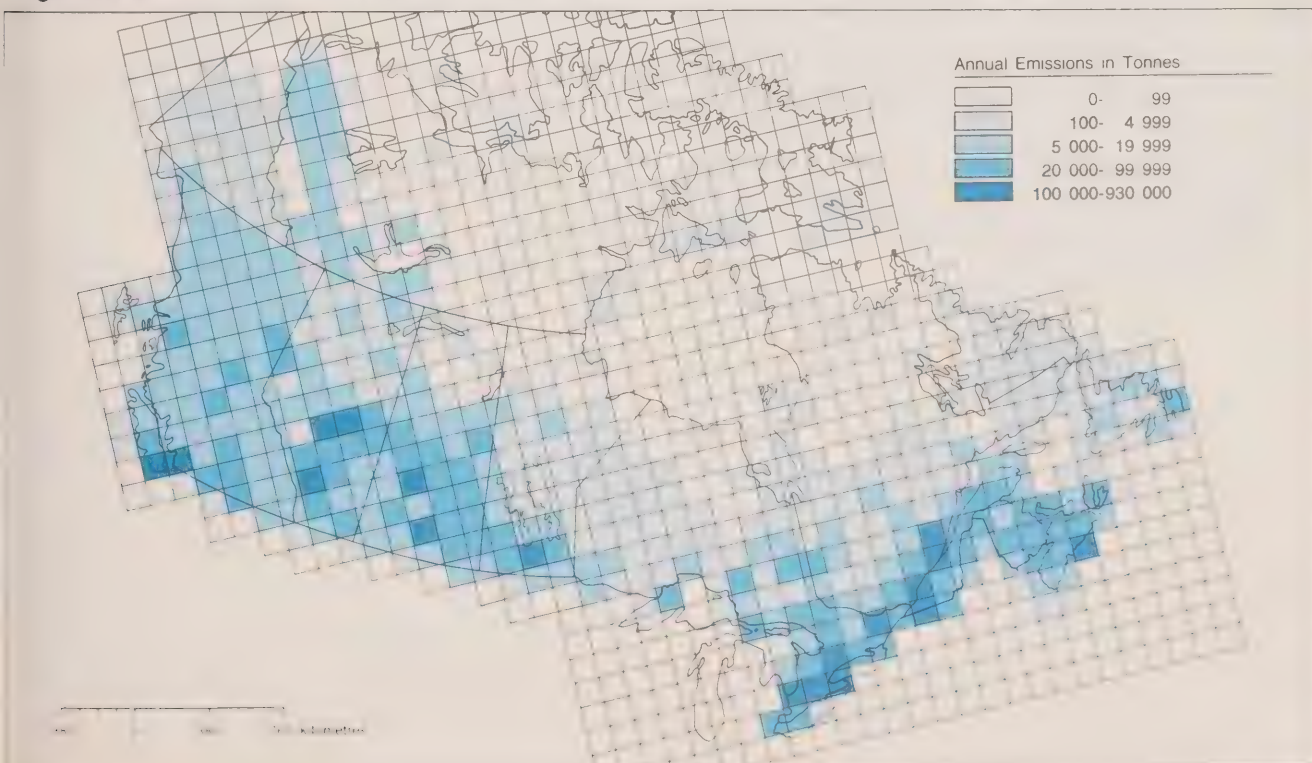
Map 6.6.3
Magnitude and Distribution of Nitrogen Oxides Emissions, 1978



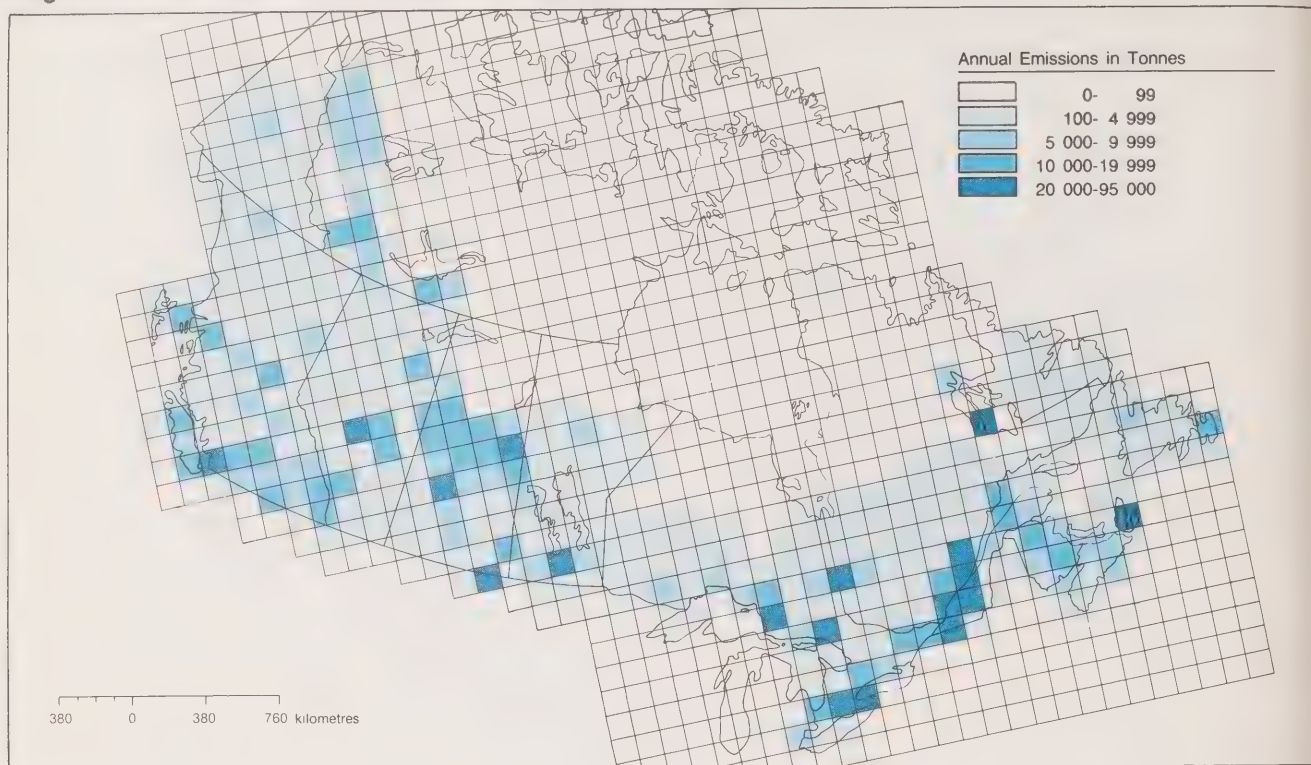
Map 6.6.4
Magnitude and Distribution of Hydrocarbon Emissions, 1978



Map 6.6.5
Magnitude and Distribution of Carbon Monoxide Emissions, 1978



Map 6.6.6

Magnitude and Distribution of Particulate Matter Emissions, 1978**Source:**

Environment Canada, *A Nationwide Inventory of Emissions of Air Contaminants, (1978)*, Report EPS 3-EP-83-10, December 1983.

Note:

Grid cells on the map are 127 kilometres by 127 kilometres in size. Point source emissions, i.e. major industrial sources, power plants and municipal incinerators, are allocated directly to the appropriate grid cell. Area source emissions, i.e. small industrial sources (e.g. sawmills), residential fuel combustion and transportation sources, are estimated for each grid cell by prorating the provincial emission estimate. Emissions for each grid cell are the sum of both point and area sources.

Estimates of the overall precision of the inventory have been calculated for SO_2 and NO_x only, as part of the *United States-Canada Memorandum of Intent on Transboundary Air Pollution* report. The precision of the SO_2 inventory was approximately $\pm 6\%$ and that of the NO_x inventory about $\pm 10\%$. Further work is being performed to establish standard methodologies for calculating uncertainty in the emission inventory.

Table 6.6.7
Trends in Emissions¹ of Sulphur Dioxide (SO₂)

Sector	1955	1965	1976	1980
kilotonnes per year				
Iron-Ferrous Smelting²	2 865	3 835	2 595	2 085
Eastern ³	2 865	3 830	2 565	2 050
Western	0	5	30	35
Power Plants	55	260	610	770
Eastern ³	50	255	550	670
Western	5	5	60	100
Non-Utility-Fuel Combustion⁴	1 000	1 130	880	610
Eastern ³	965	990	790	575
Western	35	140	90	35
Transportation	80	50	115	135
Eastern ³	50	35	85	105
Western	30	15	30	30
Non Ore Processing	110	155	165	160
Eastern ³	110	155	165	160
Western	0	0	0	0
Other⁵	425	1 160	950	870
Eastern ³	215	230	200	250
Western	210	930	750	620
Total	4 535	6 590	5 315	4 635
Eastern ³	4 255	5 495	4 355	3 810
Western	280	1 095	960	825

Emission coefficients were applied to basic data (e.g. production, quantity of fuel burned) except for major stationary sources such as non-ferrous smelters and some power plants, for which actual emission data were used.

Includes copper, nickel, lead and zinc production and pyrrhotite roasting (a process that removes sulphur to make iron more suitable for steel making). Manitoba is included in eastern Canada.

Includes fuel combustion from residential, industrial and commercial sources.

Includes sources such as natural gas processing, tar sands operations, sulphite pulping, primary aluminium production and primary lead and zinc production.

Source:

Environment Canada, Environmental Protection Service, unpublished data.

Note:

In February 1985, the Environment Ministers of seven eastern provinces (Manitoba to Newfoundland) and the Federal Minister of the Environment reached an agreement concerning specific reductions in annual SO₂ emissions in order to meet the 1994 target of 2.3 million tonnes (representing 50 percent of the 1980 level).

Table 6.6.8
Trends in Emissions¹ of Nitrogen Oxides (NO₂)

Sector	1955	1965	1976	1980
kilotonnes per year				
Transportation	330	510	980	1 075
Eastern ²	210	335	615	680
Western	120	175	365	395
Non-Utility Fuel Combustion³	230	250	350	335
Eastern ²	185	160	195	175
Western	45	90	155	160
Power plants	10	55	215	260
Eastern ²	5	45	150	165
Western	5	10	65	95
Other⁴	70	35	55	80
Eastern ²	50	15	25	30
Western	20	20	30	50
Total	640	850	1 600	1 750
Eastern ²	450	555	985	1 050
Western	190	295	615	700

Emission coefficients were applied to basic data (e.g. production, quantity of fuel burned) except for major stationary sources such as non-ferrous smelters and some power plants, for which actual emission data were used.

Manitoba is included in eastern Canada.

³ Includes fuel combustion from residential, industrial, commercial and fuelwood sources.

⁴ Includes sources such as sulphate (kraft) pulping and tar sands operations but does not include forest fires.

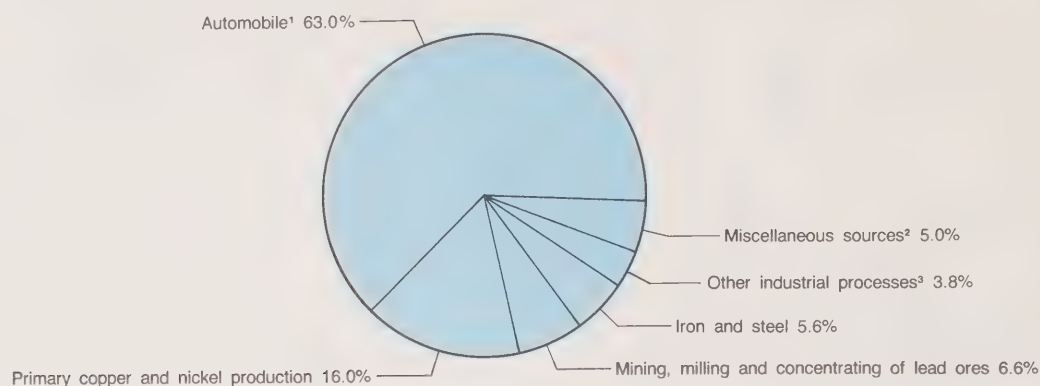
Source:

Environment Canada, Environmental Protection Service, unpublished data.

Chart 6.6.9

Sources and Emissions of Lead to the Atmosphere, 1978

Total Emissions: 14 534 tonnes



¹ The introduction of lead-free gasoline has contributed to a reduction of lead emissions from automotive exhausts of approximately twenty-eight percent between 1970 and 1978.

² Includes sources such as aircraft and solid waste incineration.

³ Includes sources such as ferrous foundries, primary lead production, lead alkyl manufacture and metal fabricating industries.

Source:

Environment Canada, *National Inventory of Sources and Emissions of Lead (1978)*, Report EPS 3-EP-83-6.

Table 6.6.10

Annual Air Quality Index for Selected Locations¹ in Canadian Cities, 1974 to 1983

City	Station Location ²	1974 ³	1975 ³	1976 ³	1977 ³	1978 ³	1979 ³	1980	1981	1982	1983
Halifax	Barrington and Duke (C)	..	33	23	22	22	26	26	27	14	21
Québec City	155 Dorchester South (C)	..	36	36	58	47	47	44	37	27	36
Montréal	Botanical Gardens (R)	45	45	40	39	37	34	35	26	26	22
	Duncan and Décarie (C)	48	50	45	43	49	51	50	47	45	46
Ottawa	88 Slater Street (C)	41	41	39	42	38	38	35	24	40	33
Toronto	67 College Street (C)	40	39	39	40	43	44	42	41	..	..
	Bathurst and Wilson (R)	..	..	38	44	42	45	38	39	40	29
	Evans and Arnold (I)	41	38	41	40	40	40	40	40	38	40
Hamilton	Barton and Sanford (C)	48	52	56	51	51	48	40	43	46	45
Winnipeg	Jefferson and Scotia (R)	..	..	39	34	28	44	41	35	27	28
Regina	1620 Albert Street (C)	..	..	..	..	..	40	41	52	35	33
Edmonton	10255-104th Street (C)	..	..	..	48	48	53	48	43	49	34
	127th St. and 133rd Ave. (R)	..	36	40	39	41	45	39	39	39	38
	17th Street and 105th Ave. (I)	30	26	26	30	25	30	30	26	27	25
Calgary	39th St and 29th Ave N.W. (R)	..	34	29	36	35	37	46	36	38	35
Vancouver	Robson and Hornby (C)	..	35	33	36	32	37	31	42	21	18
	Rocky Point Park (I)	..	..	..	..	26	32	40	43	26	25

¹ The measurements taken at a monitoring station can be considered representative of the air quality in an area surrounding the site which has a radius ranging between 0.5 and 4 kilometres (See note below for further explanation).

² Location is identified by street address and dominant activity: commercial (C), residential (R) and industrial (I).

³ Due to instrument and calibration difficulties, ozone data prior to 1979 and nitrogen dioxide data are not considered valid on a national scale. Thus in order to calculate sub-indices for these pollutants in determining the Index of Air Quality, it was necessary to use estimated sub-indices.

Sources:

Environment Canada, *National Urban Air Quality Trends, 1974-1981*, by Tom Furmanczyk, Report EPS 7 AP 14.

Environment Canada, Environmental Protection Service, unpublished data from National Air Pollution Surveillance data base.

Note:**Annual Air Quality Index**

The "Annual Air Quality Index" was designed by the Federal-Provincial Committee on Air Pollution. This index reduces the values of individual air pollution related parameters to a single number that represents both the measured and publicly perceived quality of the ambient air at a given time and location. It is an indicator of *air quality trends* and can be used to make rough comparisons of the air quality between different urban areas. However, it does not necessarily represent city-wide air quality conditions. In

Table 6.6.10
Annual Air Quality Index for Selected Locations¹ in Canadian Cities, 1974 to 1983 (concluded)

In general, air pollution levels within a city may vary and such factors as topography, meteorological conditions and distance from pollutant sources actually influence air quality of particular communities. The index is based on the average of three different pollutants that have the most significant effect on the environment during a given year. The pollutants include: sulphur dioxide, nitrogen dioxide, suspended particulate matter, carbon monoxide and ozone. In determining the index, the value which is only exceeded by 2 percent of the readings (98th percentile) is used. The remaining 2 percent of the readings usually reflect anomalies such as weather conditions or short term increases of industrial emissions and are not used.

The following scale is used to describe air quality:

Numerical Values	Categories
0-25	Good
26-50	Fair
51-100	Poor
100 and more	Very Poor

During the 1974 to 1982 period the annual mean concentrations of various pollutants in the air have shown a general decrease nationally. (SO₂, 30 percent decrease; NO₂, 25 percent decrease; suspended particulates, 24 percent decrease; lead, 60 percent decrease)

Technical Box 6.6.11

National Air Quality Objectives

Contaminant	Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Sulphur Dioxide			
parts per billion			
Annual Arithmetic Mean Average Concentration	10	20	...
Over a Twenty-four Hour Period Average Concentration	60	110	310
Over a One Hour Period	170	340	...
Suspended Particulate Matter			
micrograms per cubic metre			
Annual Geometric Mean Average Concentration	60	70	...
Over a Twenty-four Hour Period	...	120	400

¹ No objectives are set.

Source:

Environment Canada, Environmental Protection Service, *National Air Pollution Surveillance, Annual Summary, 1983*, Report EPS 7/AP/13, September 1984

Note:

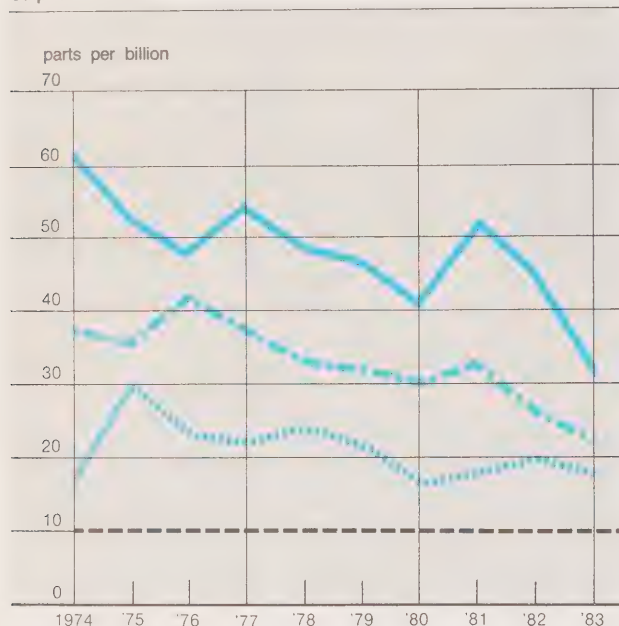
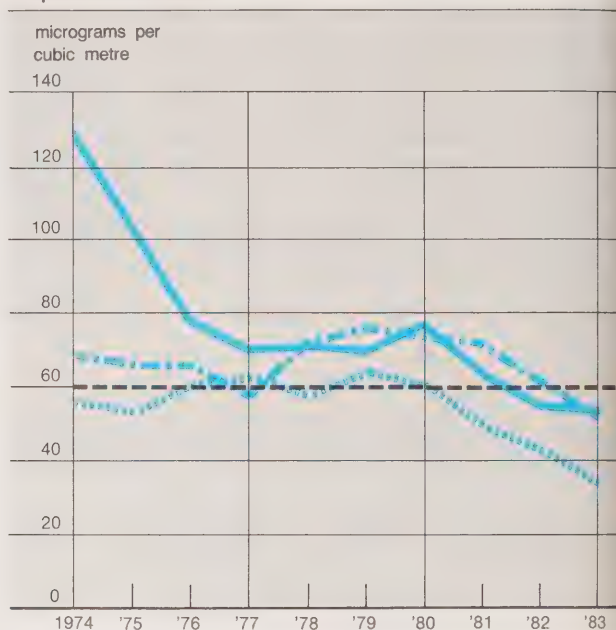
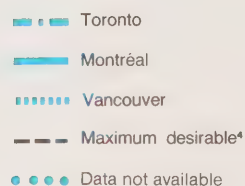
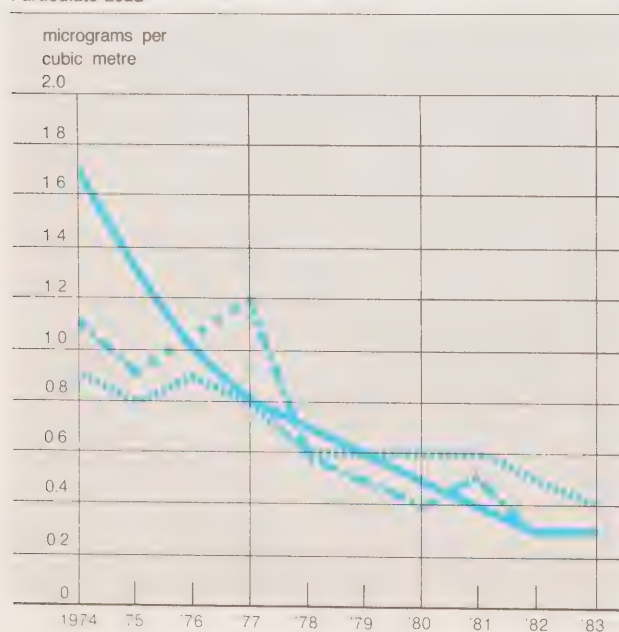
EPS has defined ambient air quality standards for the purpose of achieving objectives with respect to the protection of the environment and human health. Concentrations of air pollutants vary greatly over relatively short periods of time. Rapid changes often occur due to meteorological conditions, thus extreme levels of pollutants can result from air temperature inversions, sometimes referred to as episodic events. Exposure can be treated in terms of short duration (hourly), medium (daily) and long term (annual). (See table above). The standards are set to take into account the various factors related to exposure. EPS has defined three levels of quality as follows:

The maximum desirable level defines the long-term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of the country and for the continuing development of control technology.

The maximum acceptable level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being.

The maximum tolerable level denotes concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.

Chart 6.6.12

Trends in Selected Air Pollutants in Toronto, Montréal and Vancouver¹Sulphur Dioxide²Suspended Particulates³Particulate Lead³

¹ Annual data for each city were calculated by averaging the annual means or the 98th percentile concentrations for all selected stations.

² To show the trend in SO₂ concentrations, the second highest annual value (98th percentile) is used.

³ Monitoring for suspended particulates and particulate lead is intermittent. A twenty-four hour sample is taken every six days. The annual geometric mean is used.

⁴ This line represents the annual mean objective.

Source: Environment Canada, *National Air Pollution Surveillance*, annual summaries for years 1974 to 1983.

Technical Box 6.6.13

Water Quality and the National Water Quality Data Bank

The data on water quality parameters which are presented in Maps 6.6.14 through 6.6.16 have been obtained from NAQUADAT, the National Water Quality Data Bank of Environment Canada. NAQUADAT contains records from the National Monitoring Program as well as from other national and regional projects. Data are collected for the purpose of checking the quality of water passing between Canada and the United States, for determining ambient water quality, and for other specific purposes (e.g., industrial and municipal intake). Some parts of the system predate water quality concerns¹. Further, the sampling frequency has been irregular at many stations, and some measuring sites have only been used for short periods. As a result, it is often difficult to incorporate the details of the data base into a comprehensive picture of water quality characteristics in Canada. The maps presented

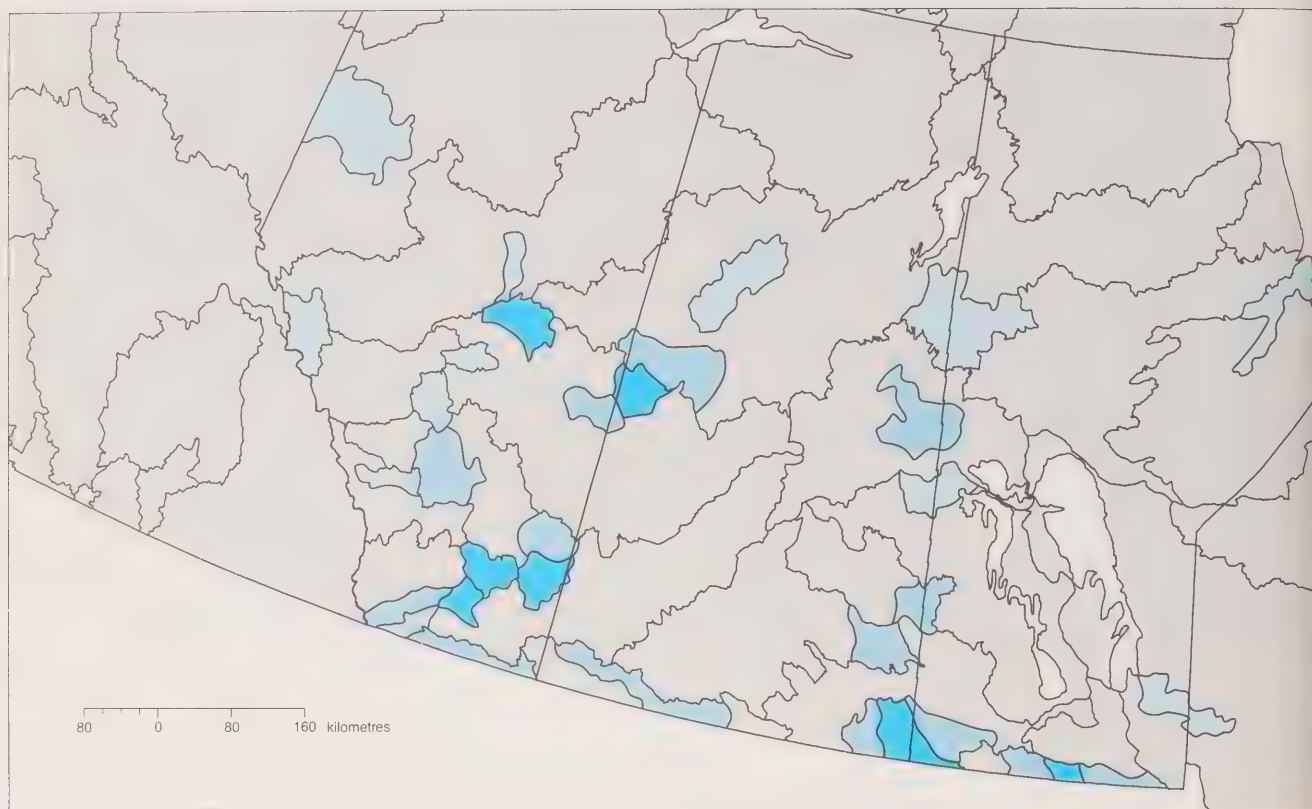
here are based on a geographic aggregation of sampling points to the level of Environment Canada sub-sub-basins² which establishes a criterion for providing a broader picture of water quality. Data gaps for much of the country remain a major problem. Basin percentages shown on the maps reflect the situation at specific stations and may not be truly representative of conditions throughout the basin. Nevertheless, other observations and studies do confirm the main features emerging from the selection of NAQUADAT data presented here.

¹ Currently, Environment Canada is reviewing locations of sampling sites and the parameters monitored.

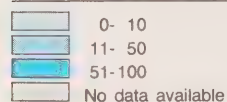
² These are either subdivisions of, or equivalent to, the Drainage Basins portrayed throughout this publication.

Map 6.6.14

**Detection of the Herbicide 2,4-D¹
in Prairie Rivers (from NAQUADAT Monitoring Stations²), 1980 to 1982**



Percentage of Samples in which 2,4-D
Was Detected in Surface Waters³



¹ 2,4-D is a herbicide used for weed control in the growing of cereal crops, and for brush control in the maintenance of pastureland.

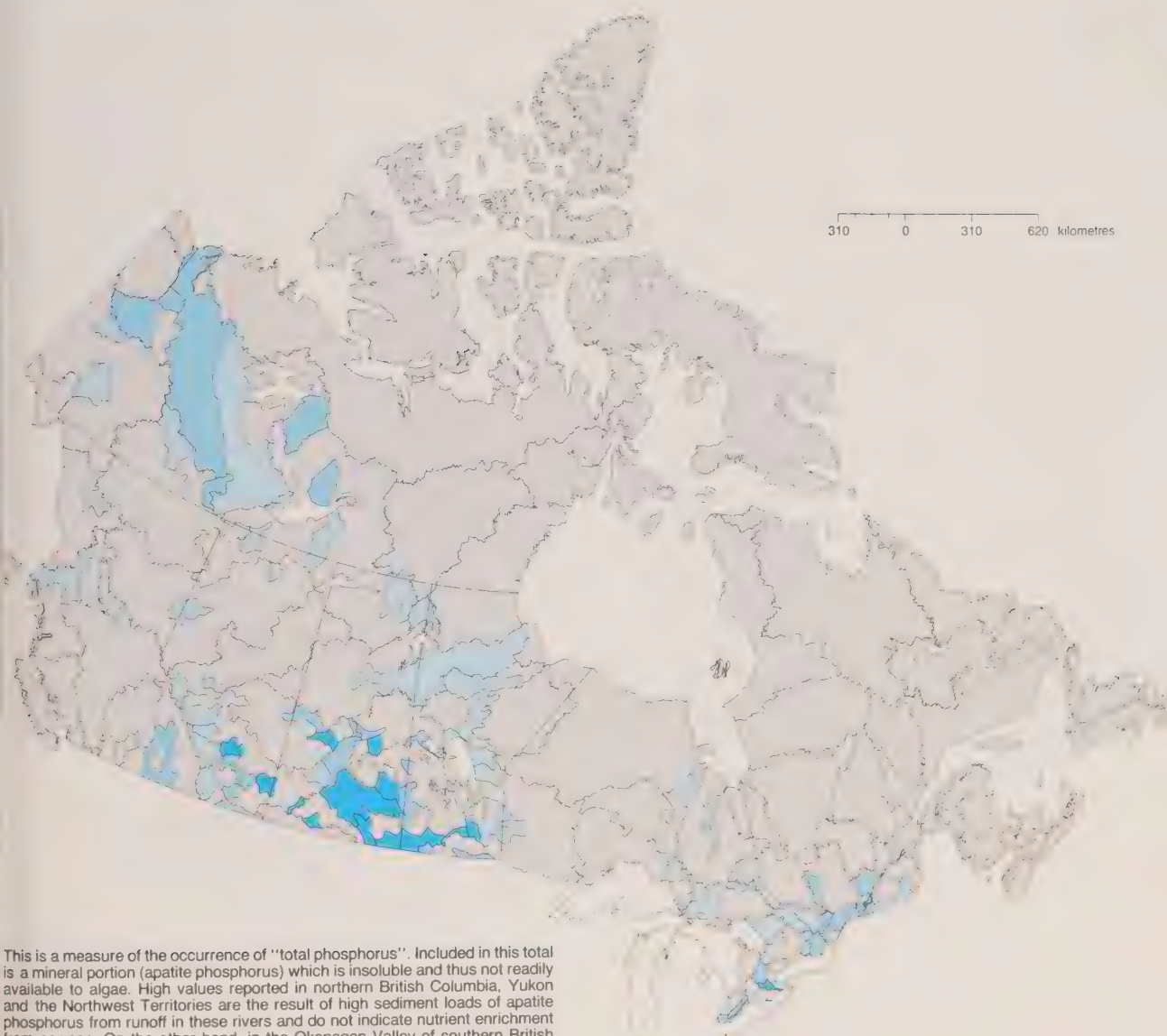
² Data from monitoring stations were aggregated to the Environment Canada sub-sub river basin level.

³ The analytical procedure used to test water quality enables scientists to detect quantities of this chemical in water samples as low as 0.004 micrograms per litre or 4 parts per trillion. The objective level designated by Health and Welfare Canada for drinking water is 1 microgram per litre of this chemical; there were no occurrences above this concentration.

Source:
Environment Canada, Inland Waters Directorate, NAQUADAT data base, special tabulations.

Note:
Although pesticides accumulate in the sediment of lakes and rivers or become bioconcentrated in animals and plants, monitoring of the surface waters can still indicate abundance, distribution and movement of these chemicals in the aquatic environment. Factors determining the concentrations in water include the intensity of agricultural application, proximity of industrial activity (related to manufacture or packaging), river flow rates, stream-bed characteristics and solubility of the chemical itself.

Map 6.6.15
 Phosphorus¹ in Canadian Rivers
 from NAQUADAT Monitoring Stations²), 1971 to 1973



This is a measure of the occurrence of "total phosphorus". Included in this total is a mineral portion (apatite phosphorus) which is insoluble and thus not readily available to algae. High values reported in northern British Columbia, Yukon and the Northwest Territories are the result of high sediment loads of apatite phosphorus from runoff in these rivers and do not indicate nutrient enrichment from sewage. On the other hand, in the Okanagan Valley of southern British Columbia, total phosphorus contains a higher proportion of soluble phosphorus and is linked to high algae growth. (See Table 6.6.23).

Data from monitoring stations were aggregated to the Environment Canada sub-sub river basin level. Only those units with at least 5 samples were recorded on this map. Since the network of stations changes from year to year, each map shows a unique set of monitored rivers. Care should therefore be taken in comparing years.

Due to the heterogeneous nature of drainage basins, no standard exists for phosphorus concentrations. However, concentrations above 0.1 milligrams per litre of total phosphorus in flowing waters increase the probability of the accelerated growth of algae.

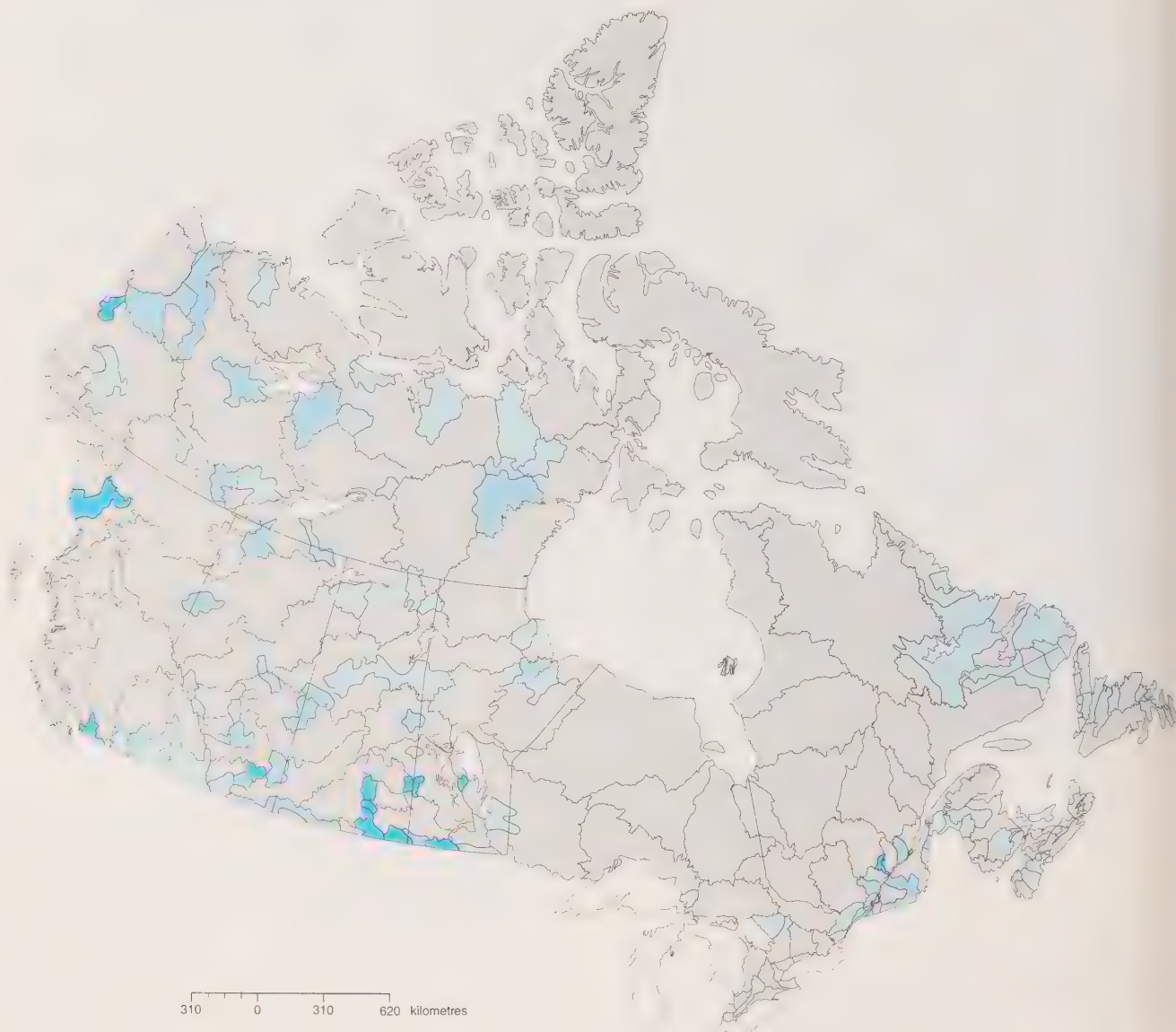
Source:
 Environment Canada, Inland Waters Directorate, NAQUADAT data base, special calculations

Note:
 The uncontrolled growth of algae contributes to the problem known as eutrophication. Data detailing concentrations of phosphorus in water which can be used as an indicator of this must be viewed in the context of the physical and chemical characteristics of the drainage basin, the location and seasonality of sources of loadings and the placement of monitoring stations.

Percentage of Samples with a Concentration of Phosphorus
 Greater Than 0.1 Milligrams per Litre³

0- 10
11- 50
51-100
Insufficient data

Map 6.6.16
Phosphorus¹ in Canadian Rivers
(from NAQUADAT Monitoring Stations²), 1980 to 1982



Source:
Environment Canada, Inland Waters Directorate, NAQUADAT data base, special tabulations.

Percentage of Samples with a Concentration of Phosphorus
Greater Than 0.1 Milligrams per Litre³





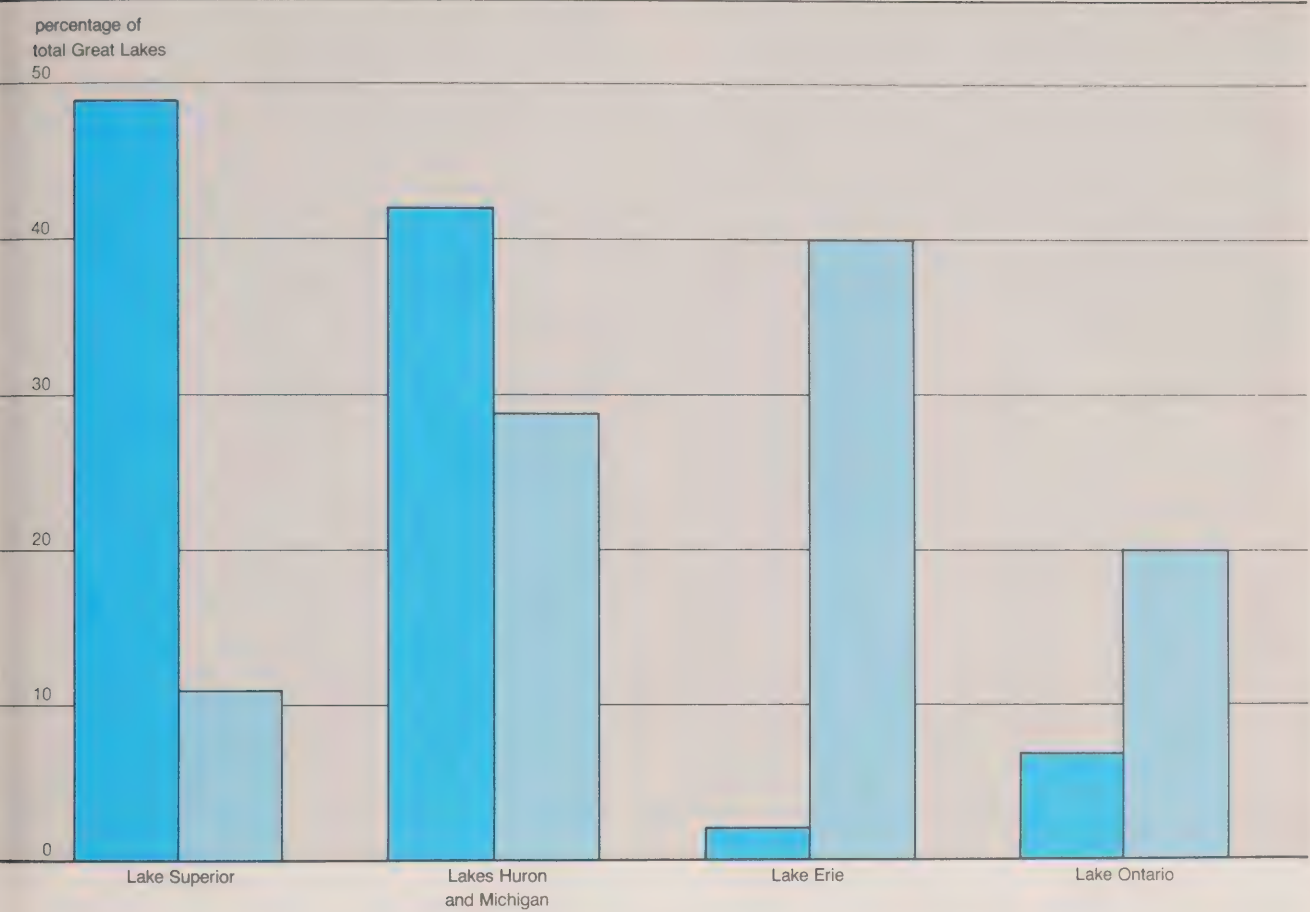
	0- 10
	11- 50
	51-100
	Insufficient data

Chart 6.6.17
Distribution of Phosphorus Loadings Relative to Great Lakes Volume¹, 1982



¹ This chart illustrates the relative stress of phosphorus loadings on the Great Lakes by comparing loading with the volume of water. For example, Lake Superior contains 49 percent of the water of the Great Lakes and receives about 11 percent of the phosphorus loading, whereas Lake Erie contains 2 percent of the volume and receives 40 percent of the load.

Source:
Great Lakes Water Quality Board, Report to the International Joint Commission, 1983 Report on Great Lakes Water Quality, Appendix, Great Lakes Surveillance.



 Lake volumes
 Phosphorus loadings, 1982

Table 6.6.18
Phosphorus Loadings to the Great Lakes, 1976 to 1982

Lake Erie:		1976		1977		1978		1979		1980		1981		1982	
		tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent
Point Sources ¹		6 006	39	5 832	40	4 631	24	2 890	24	2 452	17	1 898	18	1 455	12
Non-Point Sources															
Tributary		7 211	47	6 545	45	12 874	66	6 421	54	9 773	66	6 745	65	9 154	74
Interbasin															
Transfer		1 080	7	1 080	7	1 080	6	1 080	9	1 080	7	1 080	10	1 080	9
Atmospheric		1 119	7	1 119	8	879	4	1 550	13	1 550	10	729	7	660	5
Total		15 416	100	14 576	100	19 464	100	11 941	100	14 855	100	10 452	100	12 349	100
Percent from Canadian Sources ²			14		24		12		22		22		16		23
Target Load³		14 606		14 606		11 000		11 000		11 000		11 000		11 000	

Lake Ontario:		1976		1977		1978		1979		1980		1981		1982	
		tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent
Point Sources ¹		2 119	17	2 594	29	2 030	19	2 419	27	2 122	25	1 818	25	1 643	18
Non-Point Sources															
Tributary		4 490	35	2 970	33	2 899	26	3 200	36	3 059	36	2 435	33	3 318	37
Interbasin															
Transfer		5 613	44	2 748	31	5 250	48	3 058	35	3 087	36	2 856	38	3 330	38
Atmospheric		473	4	623	7	764	7	311	3	311	3	328	4	600	7
Total		12 695	100	8 935	100	10 943	100	8 988	100	8 579	100	7 437	100	8 891	100
Percent from Canadian Sources ²			39		38		48		51		51		51		50
Target Load³		9 072		9 072		7 000		7 000		7 000		7 000		7 000	

All Lakes ⁴		1976		1977		1978		1979		1980		1981		1982	
		tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent	tonnes	percent
Point Sources ¹		9 595	26	9 802	31	7 739	20	6 252	17	5 568	15	4 536	18	3 893	14
Non-Point Sources															
Tributary		21 248	59	16 017	51	24 517	62	18 432	51	20 631	55	17 750	72	21 500	75
Atmospheric		5 433	15	5 583	19	7 284	18	11 157	32	11 157	30	2 481	10	3 393	11
Total		36 276	100	31 402	100	39 540	100	35 841	100	37 356	100	24 767	100	28 786	100
Percent from Canadian Sources ²			24		29		22		29		30		26		30
Total Target Loads of All Lakes³		32 562		32 562		31 360		31 360		31 360		31 360		31 360	

¹ Includes direct municipal and industrial discharge.

² Excludes interbasin transfer and atmospheric sources.

³ Sum of the target phosphorus loads established by the Great Lakes Water Quality Agreement for each lake.

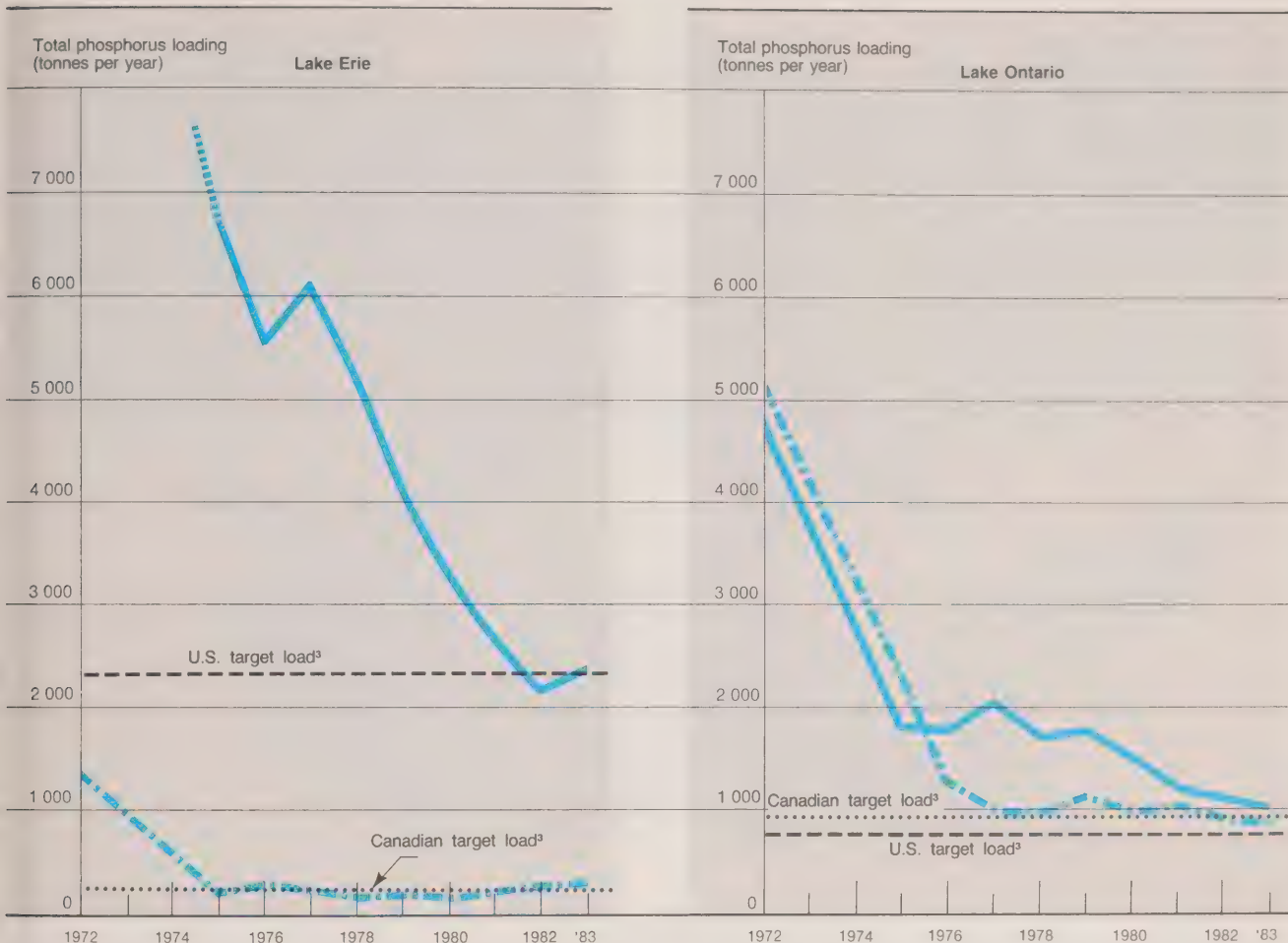
⁴ Includes St. Lawrence River.

Source:
Great Lakes Water Quality Board, Report to the International Joint Commission, *Report on Great Lakes Water Quality, Appendix, Great Lakes Surveillance*, 1976, 1977, 1978, 1981 and 1983 reports.

Note:

Target loads for the individual lakes are derived by using modelling estimates of the capacity of each lake to assimilate phosphorus loads and through bipartisan negotiation. An agreement to reduce tributary loadings (run-off from phosphorus containing fertilizer) was signed in 1983 between Canada and the United States. Further reductions are planned.

Chart 6.6.19
Lower Great Lakes Municipal Phosphorus Loads¹, 1972 to 1983



¹ The municipal phosphorus loads are based on sewage treatment plants discharging directly to the lakes and indirect discharges (i.e. tributary loadings) of major municipal sources.

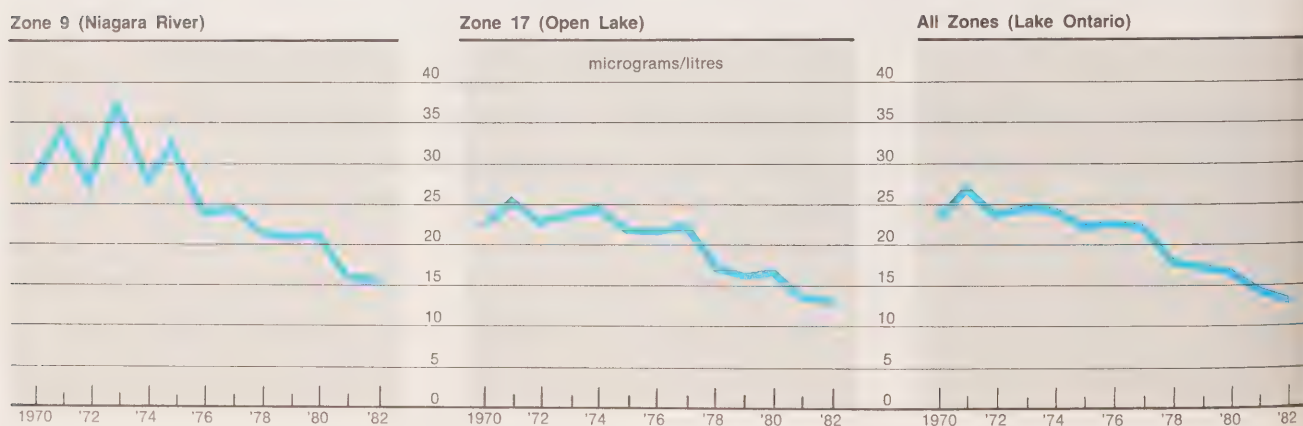
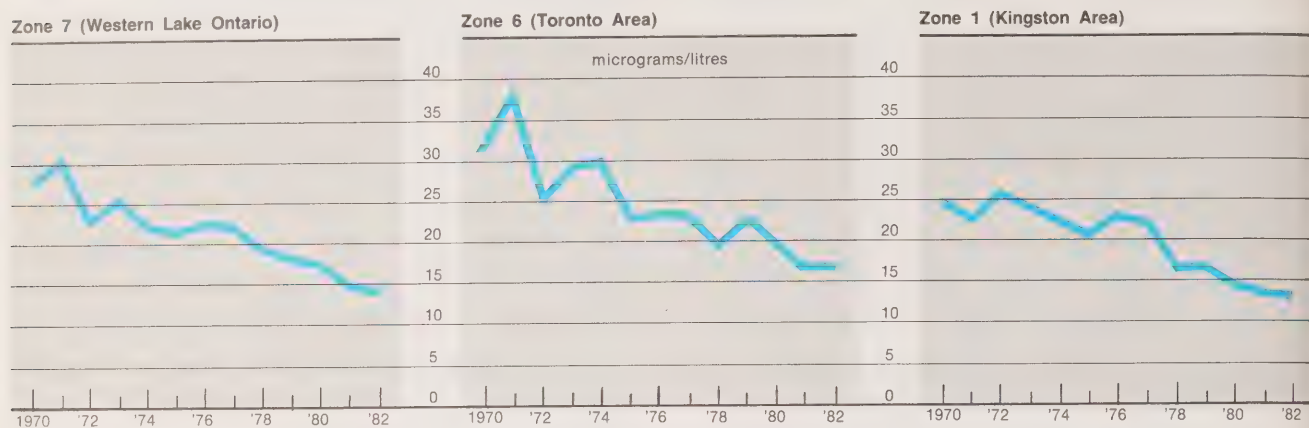
² In 1972 the phosphorus load in the American portions of the lakes was estimated at 13 870 tonnes.

³ Target loads based on the 1972 Great Lakes Water Quality Agreement between the United States and Canada which contained the provision for a 1 mg/L total phosphorus concentration limit on all major municipal point sources. The difference between target loads of the U.S.A. and Canada is related to the volume discharged in the respective countries in the reference year (1972). More stringent regulations regarding phosphorus came into effect in the late 1970s.

Source:
 Great Lakes Water Quality Board, Report to the International Joint Commission, 1985 Report on Great Lakes Water Quality.

— United States
 - - - Canada

Chart 6.6.20
Phosphorus Concentrations in Lake Ontario¹, 1970 to 1982



¹ These data are obtained from spatial sampling techniques during the "spring turnover" for individual zones.

Source:
Environment Canada, Inland Waters Directorate, Ontario Region, *Report on Status of the Open Waters of Lake Ontario*, by M. Neilson, April 1983.

Map 6.6.21
Nutrient Enrichment of the Great Lakes¹



This map illustrates trophic conditions in the Great Lakes and identifies regions showing signs of eutrophication induced by human activity. Historically, the Upper Lakes were highly oligotrophic and the Lower Lakes were likely mesotrophic due to inputs of nutrients from natural sources. Excess inputs, mainly from sewage and agriculture (see Table 6.6.18) have led to the increased and sporadic production of algae and rooted plants in the map areas indicated as eutrophic. In some instances, the taste and odour of drinking water supplies have become affected and nuisances to navigation and recreation have occurred. Ecologically, the lakes have experienced deep water oxygen depletion and changes in the physical nearshore environment affecting the life-cycle and habitat of some fish species. Eutrophication is regarded as one of the factors contributing to the breakdown of stable fish communities. (see also Technical Box 3.3.18)

Defined by levels of phosphorus, Chlorophyll A (green pigment in algae), and water clarity.

Source: International Joint Commission, 1981 *Report on Great Lakes Water Quality*, Appendix, *Great Lakes Surveillance*, Windsor, 1981. Since the original publication of this map, changes in the trophic status of the lakes have occurred. The present map incorporates more recent information.

Map 6.6.22
Lakes in the Okanagan Drainage Basin

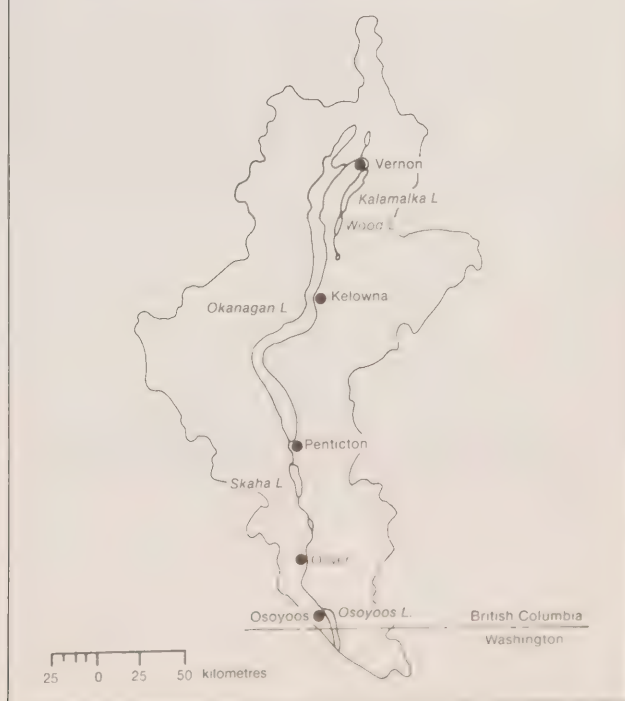


Table 6.6.23
Phosphorus Loadings¹ to Okanagan Drainage Basin Lakes, 1970 and 1980

Source ¹	Osoyoos		Skaha		Okanagan		Kalmalka		Wood	
	1970	1980	1970	1980	1970	1980	1970	1980	1970	1980
kilograms										
Point Source										
Municipal	2 700	900	13 100	2 400	37 500	17 000	0	0	0	0
Storm Water	0	0	30	35	280	475	0	0	0	0
Industrial	90	0	60	0	720	1 050	0	0	0	0
Sub-Total	2 790	900	13 190	2 435	38 500	18 525	0	0	0	0
Non-Point Source²										
Agriculture:										
Animals	300	520	480	430	2 180	8 800	300	670	410	520
Fertilizers	370	510	..	..	280	370	..	..	70	70
Logging ³	..	870	..	870	..	6 000	..	100	..	450
Septic Tanks and Other Domestic Sources	2 880	2 140	630	1 820	4 010	7 850	390	340	490	870
Atmospheric ⁴	450	450	750	750	8 900	8 900	300	300	100	100
Watershed Sources ⁵	7 100	6 200	4 200	3 300	24 500	18 500	2 200	2 100	1 650	1 200
Interbasin Transfer ⁶	8 900	8 900	3 100	3 100	140	140	340	340	..	..
Sub-Total	20 000	19 590	9 160	10 270	40 010	50 560	3 530	3 850	2 720	3 210
Total	22 790	20 490	22 350	12 705	78 510	69 085	3 530	3 850	2 720	3 210

¹ These loading estimates are based on "bioavailable phosphorus", i.e. phosphorus that is readily utilized by algae. Total phosphorus loadings calculated in Table 6.6.18 and Chart 6.6.19, include a proportion of the phosphorus which is not readily taken up by algae and other plant life.

² Non-point source loadings were aggregated to each lake basin from calculations based on the nutrient production from septic tanks and animals, and estimates of fertilizer used. An attenuation factor was applied to these loads due to soil texture and depth of ground water.

³ Monitoring results of two logged areas were extrapolated to others in the basin.

⁴ Assumes phosphorus in dustfall and precipitation are biologically available.

⁵ Watershed sources include natural run-off, for both years, and logging estimates, 1970 only. For Okanagan Lake in 1970, cattle grazing was also included.

⁶ Loadings from upstream lakes were obtained at their outlets.

Source:
Okanagan Basin Implementation Board and British Columbia Ministry of Environment, *Report on the Okanagan Basin Implementation Agreement*, 1982.

Table 6.6.24
Phosphorus Concentrations in Okanagan Drainage Basin Lakes, 1970 to 1980

Lake	Total Phosphorus Concentrations ¹							Comments on Status
	1970	1971	1976	1977	1978	1979	1980	
	micrograms per litre							
Wood	..	..	70.0	68.5	91.0	54.7	84.0	this lake is naturally nutrient rich
Kalamalka	..	..	6.0	5.0	6.5	7.0	9.8	occasional algal blooms
Okanagan								
north	..	8.7	..	9.5	8.5	9.0	10.8	nearshore deterioration
central	7.6	10.8	..	8.5	4.5	9.5	7.0	
south	..	9.8	..	7.5	6.0	5.8	7.8	
Skaha	31.0	20.7	..	11.0	18.0	22.8	24.5	variability of concentration not correlated with changes in known loadings
Osoyoos	26.9	22.8	..	21.0	23.5	17.3	21.3	nuisance algae and anoxia (seasonal)

¹ Concentration measures are obtained at four different depths at the time of the spring turnover (i.e. mixing of water of different temperatures). This is the period when phosphorus is most uniformly distributed throughout the lake.

Source:
Okanagan Basin Implementation Board and British Columbia Ministry of Environment, *Report on the Okanagan Basin Implementation Agreement*, 1982.

Map 6.6.25
Acidity of Precipitation in the United States and Canada, 1981



Source:
U.S. Geological Survey, *National Water Summary 1983 — Hydrological Events and Issues*, Washington, 1984.

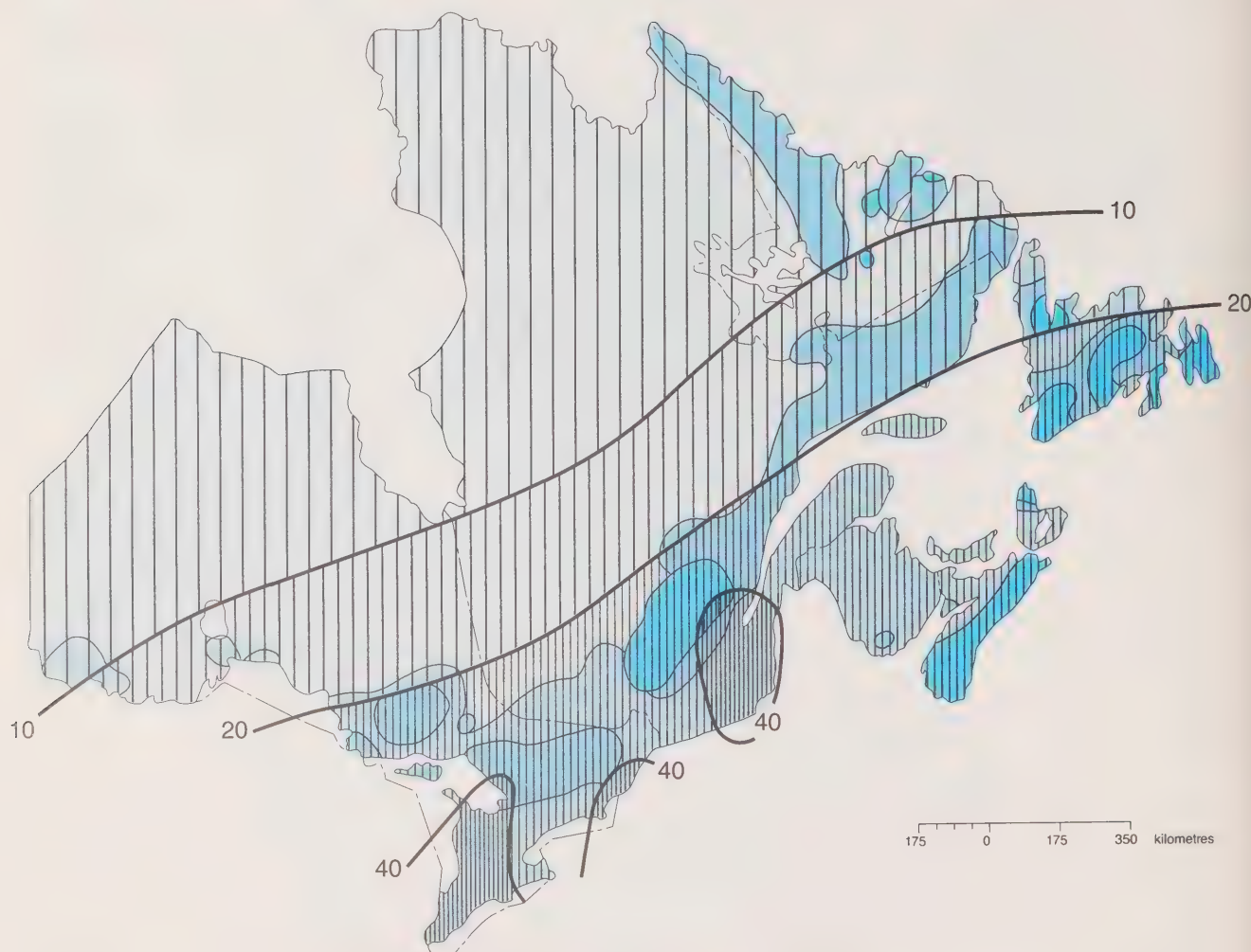
Note:

The pH scale ranges from 0 to 14 and measures whether a liquid is acidic or alkaline (basic). A value of 7 is neutral, while values below 7 indicate acidity and values above 7 indicate alkalinity. Because the scale is logarithmic, there is a 10-fold difference between one number and the next. An excess of acidic material over alkaline in the atmosphere produces acid precipitation. Factors such as wind-blown dust in the Prairies may neutralize acidic material and raise the pH of rainfall. (In the absence of contaminants, precipitation is slightly acidic with a pH of approximately 5.6). Sources of acid in the atmosphere are fossil fuel combustion for power generation, motor vehicles, metal smelting and other industrial processes. Natural sources such as volcanoes and forest fires contribute both acidic gases and alkali ash; their net effect on the acidity of precipitation is uncertain.

- 5.4 Average pH at sample site
- 5.0 — Line joining equal pH values

Map 6.6.26

Sulphate Deposition and Sensitivity¹ of Waters to Acid Precipitation in Eastern Canada



¹ Sensitivity can be characterized as the potential for a receiving body of water to be stressed by acid deposition and can be quantified using the calcite saturation index.

² Wet sulphate deposition is the weight of sulphate in rainfall and snow. Currently this measure is considered to be the best indicator of acidification. Data are from the Canadian Network for Sampling Precipitation (CANSAP) and are for 1980.

³ The calcite saturation index is a composite indicator of the ability of surface water to neutralize acid deposited in it.

Sources:

National Research Council, *Acidification in the Canadian Aquatic Environment*, Ottawa, 1981.
Impact Assessment Work Group, *United States-Canada Memorandum of Intent on Transboundary Air Pollution*, Final Report, January 1983.

Note:

Both terrestrial and aquatic ecosystems are affected by the excess of acidity and the presence of oxides of sulphur and nitrogen (SO_2, NO_x) in precipitation. Although the surrounding soil and bedrock buffering capacity (ability to resist changes in acidity) and other aspects of soil chemistry are used as factors in assessing susceptibility of aquatic ecosystems to acid rain, the chemical and hydrological characteristics of water bodies themselves must also be determined. In terrestrial systems, the proximity to point sources of emissions, run-off and snow-melt characteristics, and the type of forest cover are significant factors.

To reduce emissions, the Federal and Provincial Ministers of Environment have agreed to a maximum wet sulphate deposition level of 20 kilograms per hectare per year as the environmental objective for the acid rain control program. This is the level of deposition that would allow water bodies to assimilate acid precipitation without the pH dropping below 5.3 and would afford protection for all but the most sensitive aquatic systems. Objectives have not been established for other acidifying substances (dry sulphate and nitrates) or for terrestrial systems. It is now believed that dry sulphate deposition is a more appropriate indicator for Western Canada.

Wet Sulphate Deposition²

kilograms per hectare-year	
	less than 10
	10-20
	20-40
	greater than 40

Environment Canada has designated a target of 20 kilograms per hectare-year for sulphate deposition as part of an emissions reducing program.

Calcite Saturation Index³

	No data available
	0.0-3.0
	3.1-5.0
	5.1-7.0

Values greater than 3.0 reflect areas sensitive to acidification.

Table 6.6.27
Surface Water Area¹ by Potential to Reduce Acidity and Sulphate Deposition in Eastern Canada

Potential to Reduce Acidity ²	Wet Sulphate Deposition							
	10 to 20 kg/ha.yr.		20 to 40 kg/ha.yr.		Greater than 40 kg/ha.yr.		Total	
	km ²	percent study area	km ²	percent study area	km ²	percent study area	km ²	percent study area
High	4 644	5	6 608	7	660	<1	11 912	12
Moderate	6 674	7	16 067	17	554	<1	23 295	24
Low	31 728	34	27 308	29	400	<1	59 444	64
Total	43 046	46	49 983	53	1 622	1	94 651	100

¹ Includes only surface water area receiving more than 10 kilograms per hectare year sulphate deposition as shown in the shaded area of Map 6.6.28.

² This inventory is based on the ecological land survey developed by the Lands Directorate of Environment Canada. Using areas of land showing distinctive geology, soil and hydrology (ecodistricts), data for the potential of bedrock and soil to reduce acidity were overlaid with the deposition regime of wet sulphate (shown on Map 6.6.26). The areas shown in the table are the aggregate based on the ratio of land to water. Note that the calcite index was employed in determining areas of sensitivity in Map 6.6.26, whereas the areas of potential to reduce acidity in this table are determined by soil and bedrock characteristics.

Source:

Impact Assessment Work Group I, *United States-Canada Memorandum of Intent on Transboundary Air Pollution*, Final Report, January 1983.

Map 6.6.28
Eastern Canada Sulphate Deposition Study Area¹



¹ Area covered in Table 6.6.27 is shown in colour.

Source:

Impact Assessment Work Group, *United States-Canada Memorandum of Intent on Transboundary Air Pollution*, Final Report, January 1983.

Table 6.6.29
Spills of Hazardous Materials by Source, 1974 to 1979¹

Source	1974	1975	1976	1977	1978	1979 ²
	tonnes					
Tankers	362	81	1 574	826	78	8 080
Bulk Carriers	33	652	24	105	979	1 135
Other Watercraft	3 525	427	950	548	360	18
Tank Trucks	529	559	965	1 446	1 003	3 804
Other Motor Vehicles	869	1 640	348	484	658	526
Trains	2 288	6 534	4 026	6 611	58 417	4 886
Pipelines	10 396	2 838	4 618	3 358	5 577	15 181
Aviation	6	39	30	75	28	21
Mines and Wells	10 237	759 614	14 775	11 636	37 232	31 469
Refineries and Marine Terminals	1 049	160	368	1 232	1 529	572
Storage Depots	713	3 705	1 620	2 933	67 082	2 099
Service Stations	9	928	71	103	197	130
Industrial Plants	51 364	5 933	2 220	13 343	31 540	889
Other Sources	5 216	439 879	234 054	30 069	488	36 591
Total	86 596	1 222 989	265 643	72 769	205 168	105 401

¹ Includes oil spills and non-oil spills of substances such as acids, bases, pesticides, fertilizers, paint and dyes, minerals, metal, industrial chemicals, industrial waste, radioactive material and salt water. These data are obtained from NATES (National Analysis of Trends in Emergencies System) data base. Spill information is provided voluntarily by several federal and provincial regulatory agencies. Therefore, the data base is not necessarily complete.

² 1979 is the last date for which data have been compiled.

Source:
Environment Canada, Environmental Protection Service, NATES data base.

7

Biotic State



Contents

7.1	Wildlife	287
7.2	Contaminants and Biotic Response	313

Tables

7.1.1	Terrestrial Mammal Species by Ecozone	288
7.1.2	Marine Mammal Species by Ocean	289
7.1.3	Large Mammal Species by Ecozone	289
7.1.6	Breeding Bird Species by Ecozone	292
7.1.11	Animal Pelts Taken 1982-1983	297
7.1.13	Sport and Native Hunting Kills of Large Mammals, by Province, 1983	299
7.1.16	Migratory Birds Killed, by Province, 1983	301
7.1.17	Waterfowl Killed, by Province, 1967 to 1983	301
7.1.18	Mammal Species in Jeopardy	302
7.1.19	Bird Species in Jeopardy	303
7.1.20	Fish and Reptile Species in Jeopardy	304
7.1.21	Plant Species in Jeopardy	305
7.1.22	Non-Native Mammal Introductions	307
7.1.23	Non-Native Bird Introductions	308
7.1.24	Exotic Fish Introductions	309
7.2.6	DDT and PCB Residues in Atlantic Seabird Eggs	319
7.2.11	Mercury Concentration in Walleye in Lake St. Clair and Lake Simcoe, 1970 to 1983	324
7.2.12	Mercury Concentration in Walleye in Lakes of the Prairie Provinces, 1971 to 1983	324
7.2.13	Mercury Concentration in Walleye and Pike in Québec Drainage Basins, 1979	325
7.2.14	Mercury Concentration in Fish from the Fraser River, 1980	325

Maps

7.1.4	Mammal Species by Ecozone	290
7.1.5	Mammal Species by Drainage Basin	291
7.1.7	Breeding Bird Species by Ecozone	293
7.1.8	Breeding Bird Species	294
7.1.9	Distribution of Caribou and Population of Major Herds	295
7.1.10	Distribution and Population of Polar Bear	296
7.1.25	Range Change of Selected Species	310
7.2.2	PCB Residues in Spottail Shiners from Selected Great Lakes Sites	315
7.2.3	DDT Residues in Spottail Shiners from Selected Great Lakes Sites	316
7.2.5	DDT and PCB Residues in Herring Gull Eggs from Selected Great Lakes Nesting Colonies	318
7.2.7	Dioxin Concentrations in Herring Gull Eggs from Selected Great Lakes Nesting Colonies, 1980 to 1984	320
7.2.8	Dioxin Residue in Spottail Shiners from Selected Niagara River Sites, 1981	321
7.2.15	Acidity of Atlantic Salmon Rivers in the Maritime Provinces	326

Charts

7.1.12	Beaver, Lynx and Muskrat Pelts Taken, 1920 to 1984	298
7.1.14	Ducks on the Western Plains, 1955 to 1984	300
7.1.15	Prairie Ponds, 1955 to 1984	300
7.2.4	DDT and PCB Residues in Spottail Shiners from Selected Niagara River Sites	317
7.2.10	Mercury Concentration in Walleye in the English-Wabigoon River System, 1970 to 1981	323
7.2.16	Angling Catch of Atlantic Salmon in Twenty-two Nova Scotia Rivers by Level of Acid Stress, 1940 to 1980	327

Technical Boxes

7.2.1	Contaminants in Biota: an Indicator of Environmental Response	314
7.2.9	Mercury Contamination in Biota: an Indicator of Environmental Response	322

7.1

Wildlife



Table 7.1.1
Terrestrial Mammal Species¹ by Ecozone

Scientific Name	Common Name	Number of Species in Canada	Ecozone ⁴														
Order ²			A.M.	M.P.	B.S.	Pr.	B.P.	M.C.	P.M.	B.C.	T.C.	T.P.	T.S.	H.B.P.	S.A.	N.A.	A.C.
Family ³																	
<i>Marsupialia</i>	Marsupials	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
<i>Didelphidae</i>	Opossum	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
<i>Insectivora</i>	Insectivores	18	7	9	9	4	5	5	9	4	4	5	4	5	0	0	0
<i>Soricidae</i>	Shrews	6	6	6	7	4	5	5	6	4	4	5	3	4	0	0	0
<i>Talpidae</i>	Moles	12	1	3	2	0	0	0	3	0	0	0	1	1	0	0	0
<i>Chiroptera</i>	Bats	17	5	9	5	8	5	11	10	1	1	1	1	1	0	0	0
<i>Vespertilionidae</i>	Smooth-faced Bats	16	5	9	5	8	5	11	9	1	1	1	1	1	0	0	0
<i>Molossidae</i>	Free-tailed Bats	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
<i>Lagomorpha</i>	Pikas, Hares and Rabbits	7	1	3	1	4	1	2	3	2	2	1	2	1	1	1	1
<i>Ochotonidae</i>	Pikas	6	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0
<i>Leporidae</i>	Rabbits and Hares	1	1	3	1	4	1	1	2	1	1	1	2	1	1	1	1
<i>Rodentia</i>	Rodents	68	18	21	19	26	17	29	22	22	20	17	15	15	8	2	2
<i>Aplodontidae</i>	Mountain Beaver	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
<i>Sciuridae</i>	Squirrels	22	5	7	5	9	5	10	5	6	5	5	3	4	1	0	0
<i>Geomyidae</i>	Pocket Gophers	2	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
<i>Heteromyidae</i>	Pocket Mice and Kangaroo Rats	3	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0
<i>Castoridae</i>	Beavers	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
<i>Muridae</i>	Rats, Mice, and Voles	33	9	9	10	11	8	13	13	12	13	9	9	7	7	2	2
<i>Dipodidae</i>	Jumping Mice and Jerboas	4	2	2	2	1	1	1	1	2	0	1	1	2	0	0	0
<i>Erethizontidae</i>	Porcupines	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
<i>Capromyidae</i>	Hutias and Coypus	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
<i>Carnivora</i>	Carnivores	24	9	10	14	14	16	18	14	13	12	14	11	14	8	6	6
<i>Canidae</i>	Dogs	5	1	3	3	3	3	3	2	3	3	4	3	3	3	3	3
<i>Ursidae</i>	Bears	3	1	0	1	1	1	2	2	2	2	1	1	2	2	1	1
<i>Procyonidae</i>	Raccoons and their Allies	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
<i>Mustelidae</i>	Weasels and their Allies	12	4	5	7	6	9	10	8	7	6	8	6	8	3	2	2
<i>Felidae</i>	Cats	3	2	1	2	3	2	3	1	1	1	1	1	1	0	0	0
<i>Artiodactyla</i>	Cloven-Hoofed Mammals	12	2	1	3	5	6	7	4	4	4	4	2	2	3	2	1
<i>Cervidae</i>	Deer	6	2	1	3	3	5	5	3	2	2	3	2	2	2	1	1
<i>Antilocapridae</i>	Pronghorns	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
<i>Bovidae</i>	Antelopes, Cattle, Sheep and Goats	5	0	0	0	1	1	2	1	2	2	1	0	0	1	1	0
Total Number of Species:			147	42	54	51	61	50	72	63	46	43	42	35	38	18	10

¹ Species: A taxonomic group of similar individuals that interbreed freely among themselves (or are biologically capable of doing so) but do not normally breed with individuals of other such groups; popularly thought of as a kind of plant or animal.

² Order: A taxonomic group composed of related families.

³ Family: A taxonomic group composed of related species.

⁴ Ecozone Abbreviations:

A.M. — Atlantic Maritime
M.P. — Mixed-Wood Plain
B.S. — Boreal Shield
Pr. — Prairie
B.P. — Boreal Plain
M.C. — Montane Cordillera
P.M. — Pacific Maritime
B.C. — Boreal Cordillera
T.C. — Tundra Cordillera
T.P. — Taiga Plain
T.S. — Taiga Shield

H.B.P. — Hudson Bay Plain

S.A. — Southern Arctic

N.A. — Northern Arctic

A.C. — Arctic Cordillera

Source:

The National Museums of Canada, *The Mammals of Canada*, by A.W.F. Banfield, 1977. Special tabulations by the Office of the Senior Adviser on Integration, Statistics Canada.

Note:

Species distribution data can serve as crude indicators of species diversity and ecosystem resilience. Ecological systems that maintain a large variety of species are generally complex and usually provide varied opportunities for alternate survival strategies for individual species when under human or natural stress.

The data in this Table and Tables 7.1.2, 7.1.3, 7.1.6 and Maps 7.1.4, 7.1.5 and 7.1.7 were derived by a map overlay technique. To be included in a particular ecozone, a species had to meet one of two criteria: 1.) The species' range area had to cover at least one-quarter of the ecozone, or 2.) for species with very restricted ranges, at least one-quarter of the species' range area had to be within the ecozone.

Table 7.1.2
Marine Mammal Species by Ocean¹

Scientific Name Order Family	Common Name	All Canadian Marine Waters	Atlantic Ocean	Arctic Ocean	Pacific Ocean
number of species					
Cetacea	Whales	33	22	14	22
Ziphiidae	Beaked Whales	8	4	1	4
Physeteridae	Sperm Whale	1	1	1	1
Kogiidae	Pigmy Sperm Whales	1	1	0	1
Monodontidae	White Whale and Narwhal	2	1	2	0
Delphinidae	Dolphins and Porpoises	13	8	4	9
Eschrichtidae	Greywhale	1	0	0	1
Balaenopteridae	Forquals	5	5	4	5
Balaenidae	Bowhead Whales	2	2	2	1
Pinnipedia	Seals, Sea Lions and Walrus	12	7	8	5
Otariidae	Eared Seals	4	0	2	3
Odobenidae	Walrus	1	1	1	0
Phocidae	True Seals	7	6	5	2
Carnivora	Carnivores	1	0	0	1
Mustelidae	Sea Otter ²	1	0	0	1
Total Number of Species		46	29	32	28

¹ Canadian waters (ie. within 200 nautical mile limit).
² The sea otter is a species of the family Mustelidae (weasels). This species is the only marine aquatic member of this family found in Canada.

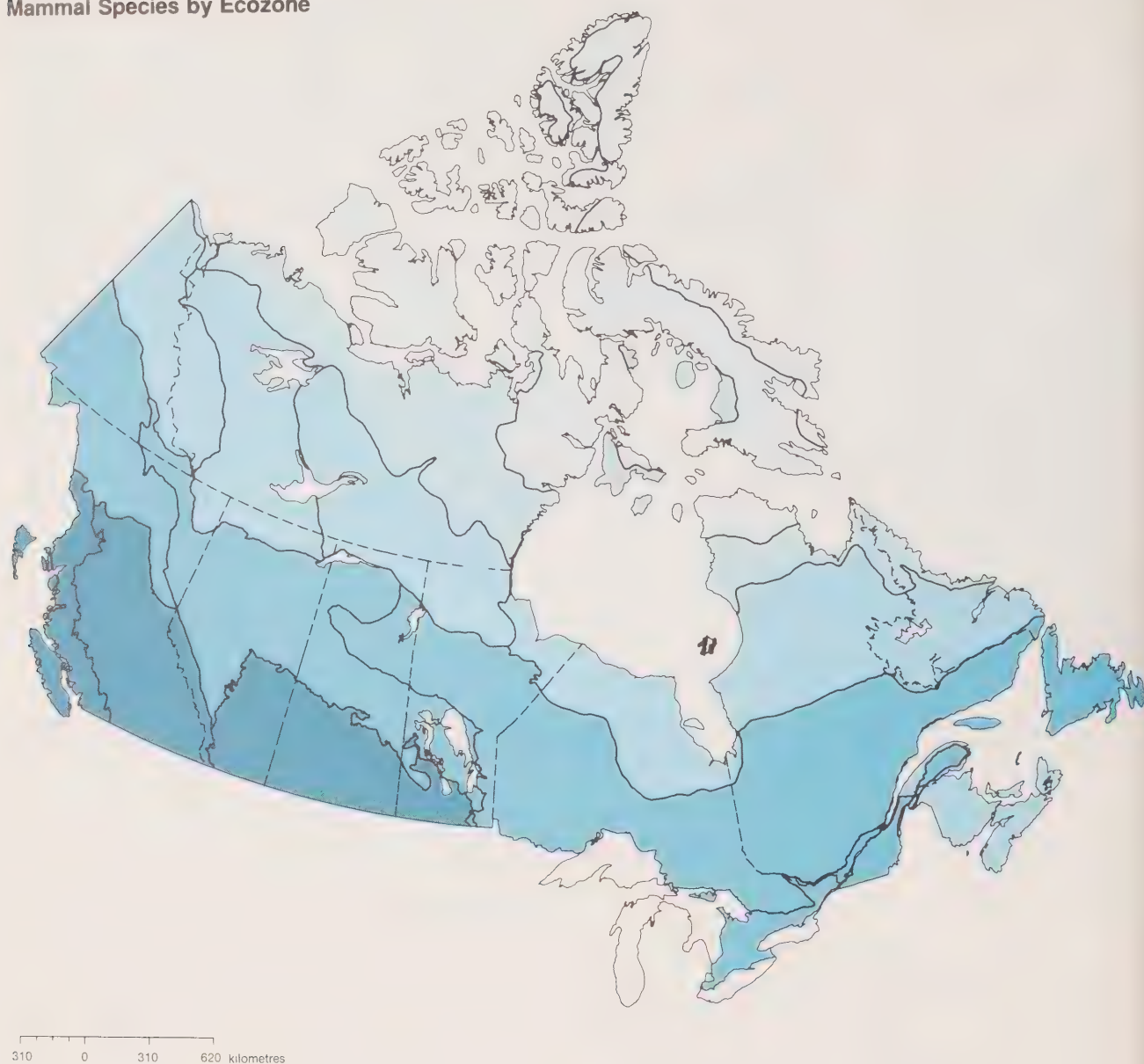
Source:
The National Museums of Canada, *The Mammals of Canada*, by A.W.F. Banfield, 1977.
Special tabulations by the Office of the Senior Adviser on Integration, Statistics Canada.

Table 7.1.3
Large Mammal Species by Ecozone

Species Common Name	Atlantic Maritime	Mixed- Wood Plain	Boreal Shield	Prairie	Boreal Plain	Montane Cordillera	Pacific Maritime	Boreal Cordillera	Tundra Cordillera	Taiga Plain	Taiga Shield	Hudson Bay Plain	Southern Arctic	Northern Arctic	Arctic Cordillera
Coyote	X	X	X	X	X	X		X	X	X			X	X	X
Wolf			X		X	X	X	X	X	X	X	X	X	X	X
Arctic Fox									X				X	X	
Red Fox	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Grey Fox		X		X											
Black Bear	X		X	X	X	X	X	X	X	X	X				
Grizzly Bear						X	X	X	X						
Polar Bear												X	X	X	X
Cougar				X	X	X	X					X			
Lynx	X		X	X	X	X		X	X	X	X	X			
Bobcat	X	X	X	X		X		X		X	X	X	X	X	X
Caribou			X		X				X	X					
Mule Deer				X	X	X	X			X					
White-tailed Deer	X	X	X	X	X	X									
Moose	X		X		X	X		X	X	X	X	X	X		
Fallow Deer							X								
Elk				X	X	X	X								
Bison				X	X					X					
Mountain Goat						X	X	X	X				X	X	
Bighorn Sheep						X									
Dall's Sheep								X	X						
Muskox														X	
Pronghorn				X											

Sources:
National Museums of Canada, *The Mammals of Canada*, by A.W.F. Banfield, 1977.
Special tabulation by the Office of the Senior Adviser on Integration, Statistics Canada.

Map 7.1.4






Mammal Species by Ecozone**Sources:**

The National Museums of Canada, *The Mammals of Canada*, by A.W.F. Banfield, 1977.
 Special tabulations by the Office of the Senior Adviser on Integration, Statistics Canada.

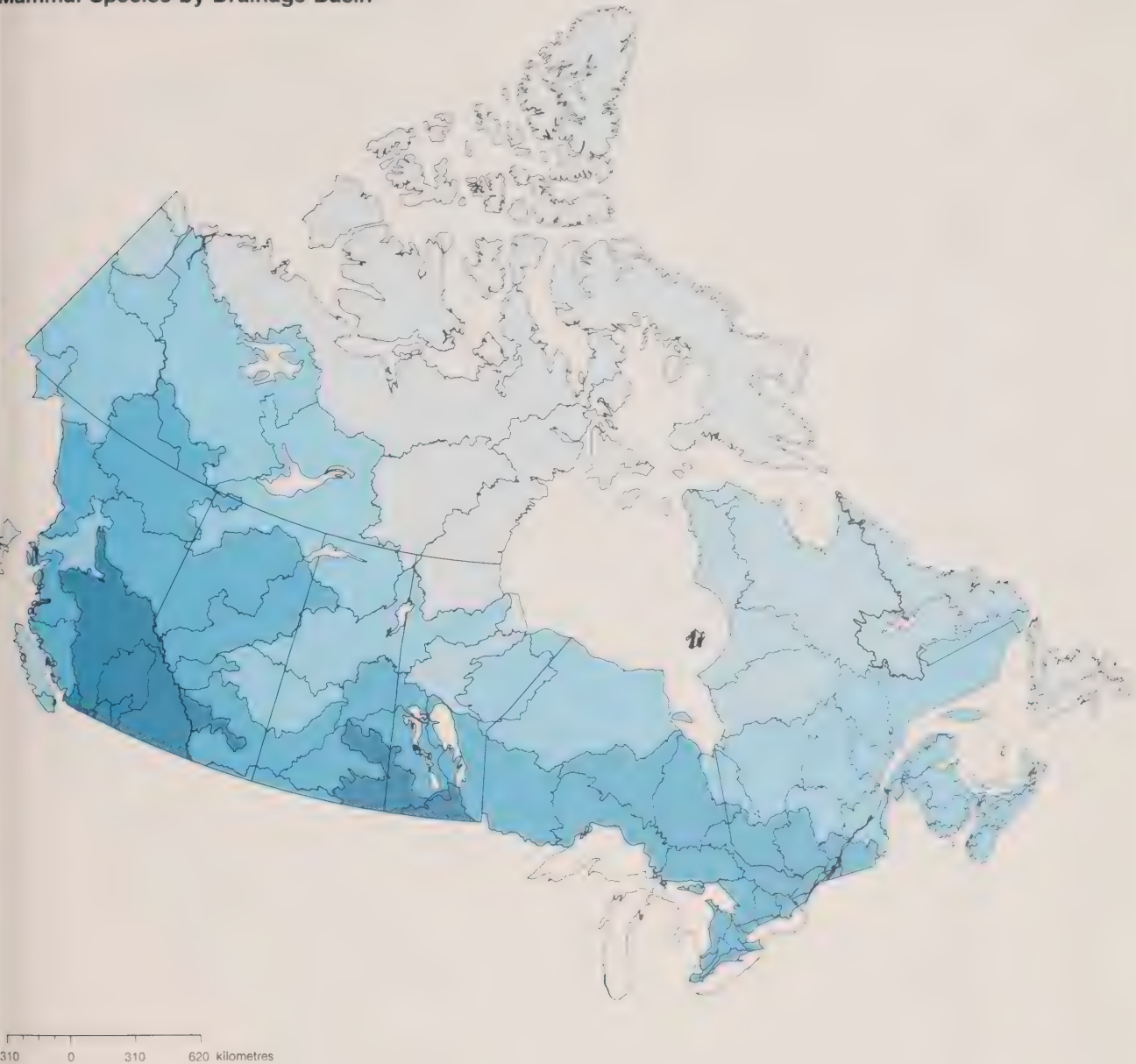
Note:

Refer to Table 7.1.1 for methodology details.

Number of Species

	< 15
	15-29
	30-44
	45-59
	> 59

Map 7.1.5
Mammal Species by Drainage Basin



Sources:
The National Museums of Canada, *The Mammals of Canada*, by A.W.F. Banfield, 1977.
Special tabulations by the Office of the Senior Adviser on Integration, Statistics Canada.

Note:
Species information by drainage basin was compiled in the same manner as species statistics for ecozones. For details, see note on Table 7.1.1.

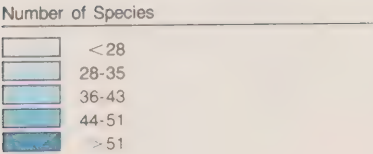


Table 7.1.6
Breeding Bird Species by Ecozone

Scientific Name	Common Name	Number of Species in	Ecozone ¹															
			Canada	A.M.	M.P.	B.S.	Pr.	B.P.	M.C.	P.M.	B.C.	T.C.	T.P.	T.S.	H.B.P.	S.A.	N.A.	A.C.
Gaviiformes	Loons	4	1	1	1	0	1	1	1	1	1	2	3	3	2	3	4	1
Podicipediformes	Grebes	5	1	2	3	5	5	5	2	2	2	2	2	2	2	0	0	0
Procellariiformes	Petrels and Allies	3	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0	1
Pelecaniformes	Pelicans, Cormorants, and Allies	5	3	1	3	2	2	2	0	2	0	0	0	0	0	0	0	0
Ciconiiformes	Herons, Storks and Allies	6	5	6	2	5	3	1	1	0	0	1	1	1	1	0	0	0
Anseriformes	Swans, Geese and Ducks	35	12	13	17	17	21	20	11	18	15	16	11	17	10	8	5	
Falconiformes	Diurnal Birds of Prey	19	10	10	11	10	10	14	11	12	10	8	4	9	5	3	1	
Cathartidae	American Vultures	1	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0
Accipitridae	Kites, Hawks, Eagles, Harriers	12	7	7	8	6	7	8	6	7	5	5	3	6	3	1	1	
Pandionidae	Ospreys	1	1	1	1	0	1	1	1	1	1	1	0	1	0	0	0	0
Falconidae	Falcons	5	2	1	2	3	2	4	3	4	4	2	1	2	2	2	0	0
Galliformes	Pheasant, Grouse and Allies	15	4	5	5	6	6	10	8	6	7	6	3	4	2	2	1	
Gruiformes	Cranes, Rails, and Allies	7	4	5	4	2	5	2	3	0	0	2	2	3	1	1	0	
Charadriiformes	Shorebirds, Gulls, and Allies	71	13	12	20	16	19	10	12	15	13	15	17	20	26	27	16	
Haematopodidae	Oystercatchers	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Charadriidae	Plovers, Surfbirds, Turnstones	7	3	2	2	2	2	1	1	1	2	3	1	2	2	4	3	
Scolopacidae	Woodcock, Snipe, Sandpipers	26	4	4	6	6	8	5	2	9	7	6	8	11	13	9	3	
Recurvirostridae	Avocets and Stilts	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Phalaropodidae	Phalaropes	3	0	1	0	1	1	1	0	1	0	0	1	1	2	2	2	
Stercorariidae	Jaegers and Skuas	3	0	0	0	0	0	0	0	0	0	0	1	1	3	3	2	
Laridae	Gulls and Terns	19	4	5	7	6	8	3	2	4	4	6	5	5	4	8	4	
Alcidae	Auks, Murres and Puffins	11	2	0	5	0	0	0	6	0	0	0	1	0	2	1	2	
Columbiformes	Pigeons and Doves	3	2	2	1	2	2	2	3	0	0	0	0	0	0	0	0	
Cuculiformes	Cuckoos	2	1	2	1	1	0	0	1	0	0	0	0	0	0	0	0	
Strigiformes	Owls	14	5	7	8	6	8	11	9	5	5	6	4	5	2	1	1	
Caprimulgiformes	Goatsuckers	3	2	2	2	2	2	2	1	1	1	1	1	1	0	0	0	
Apodiformes	Swifts and Hummingbirds	7	2	2	2	2	2	5	3	2	0	0	0	0	0	0	0	
Coraciiformes	Kingfisher	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	
Paciiformes	Woodpecker and Allies	11	8	6	7	5	7	9	7	7	4	7	3	6	0	0	0	
Passeriformes	Perching Birds	183	86	101	89	84	97	105	85	73	49	68	39	56	14	8	8	
Tyrannidae	Flycatchers	15	8	8	8	8	9	10	8	4	6	8	3	5	0	0	0	
Alaudidae	Larks	2	1	1	1	1	1	1	2	1	1	0	1	1	1	1	1	
Hirundinidae	Swallows	7	5	6	1	6	5	6	6	5	5	4	2	3	0	0	0	
Corvidae	Jays, Magpies and Crows	8	4	3	4	3	5	6	4	4	2	3	2	3	1	1	1	
Paridae	Titmice, Verdins, Bushtits	6	2	1	4	1	2	4	3	3	2	2	1	2	0	0	0	
Sittidae	Nuthatches	3	2	2	2	1	2	3	1	1	0	1	0	0	0	0	0	
Certhiidae	Creepers	1	1	1	1	0	1	1	1	0	0	0	0	1	0	0	0	
Cinclidae	Dippers	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	
Troglodytidae	Wrens	7	2	6	0	4	4	4	4	1	0	0	0	1	0	0	0	
Mimidae	Mockingbirds and Thrashers	4	1	3	2	3	2	2	1	0	0	0	0	0	0	0	0	
Turdidae	Thrushes, Solitaires and Bluebirds	12	5	6	2	5	5	8	7	8	7	4	3	2	3	1	1	
Sylviidae	Warblers, Gnatcatchers and Kinglets	3	2	2	5	0	2	2	2	2	1	1	1	1	0	0	0	
Motacillidae	Wagtails and Pipits	2	0	0	2	1	1	1	1	1	1	0	1	1	1	1	1	
Bombycillidae	Waxwings	2	1	1	0	1	2	2	1	2	1	1	1	1	0	0	0	
Laniidae	Shrikes	2	1	1	2	1	0	0	0	1	1	1	1	0	0	0	0	
Sturnidae	Starlings	2	1	1	1	1	1	1	2	0	0	0	0	1	0	0	0	
Vireonidae	Vereos	6	3	4	3	4	4	3	4	3	0	3	0	1	0	0	0	
Parulidae	Wood Warblers	36	22	24	25	9	21	14	10	13	7	14	7	14	0	0	0	
Ploceidae	Weaver Finches	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	0	
Icteridae	Meadowlarks, Blackbirds and Orioles	12	6	8	5	10	8	8	5	2	2	4	1	1	0	0	0	
Thraupidae	Tanagers	2	0	1	1	0	1	1	1	1	0	1	0	0	0	0	0	
Fringillidae	Grosbeaks, Finches, Sparrows and Buntings	49	18	21	19	24	20	26	20	19	13	20	15	17	8	4	4	
Total Number of Species			394	161	178	178	166	191	198	163	143	109	136	91	127	63	54	34

¹ Ecozone Abbreviations:

A.M.	— Atlantic Maritime	T.C.	— Tundra Cordillera
M.P.	— Mixed-Wood Plain	T.P.	— Taiga Plain
B.S.	— Boreal Shield	T.S.	— Taiga Shield
Pr.	— Prairie	H.B.P.	— Hudson Bay Plain
B.P.	— Boreal Plain	S.A.	— Southern Arctic
M.C.	— Montane Cordillera	N.A.	— Northern Arctic
P.M.	— Pacific Maritime	A.C.	— Arctic Cordillera
B.C.	— Boreal Cordillera		

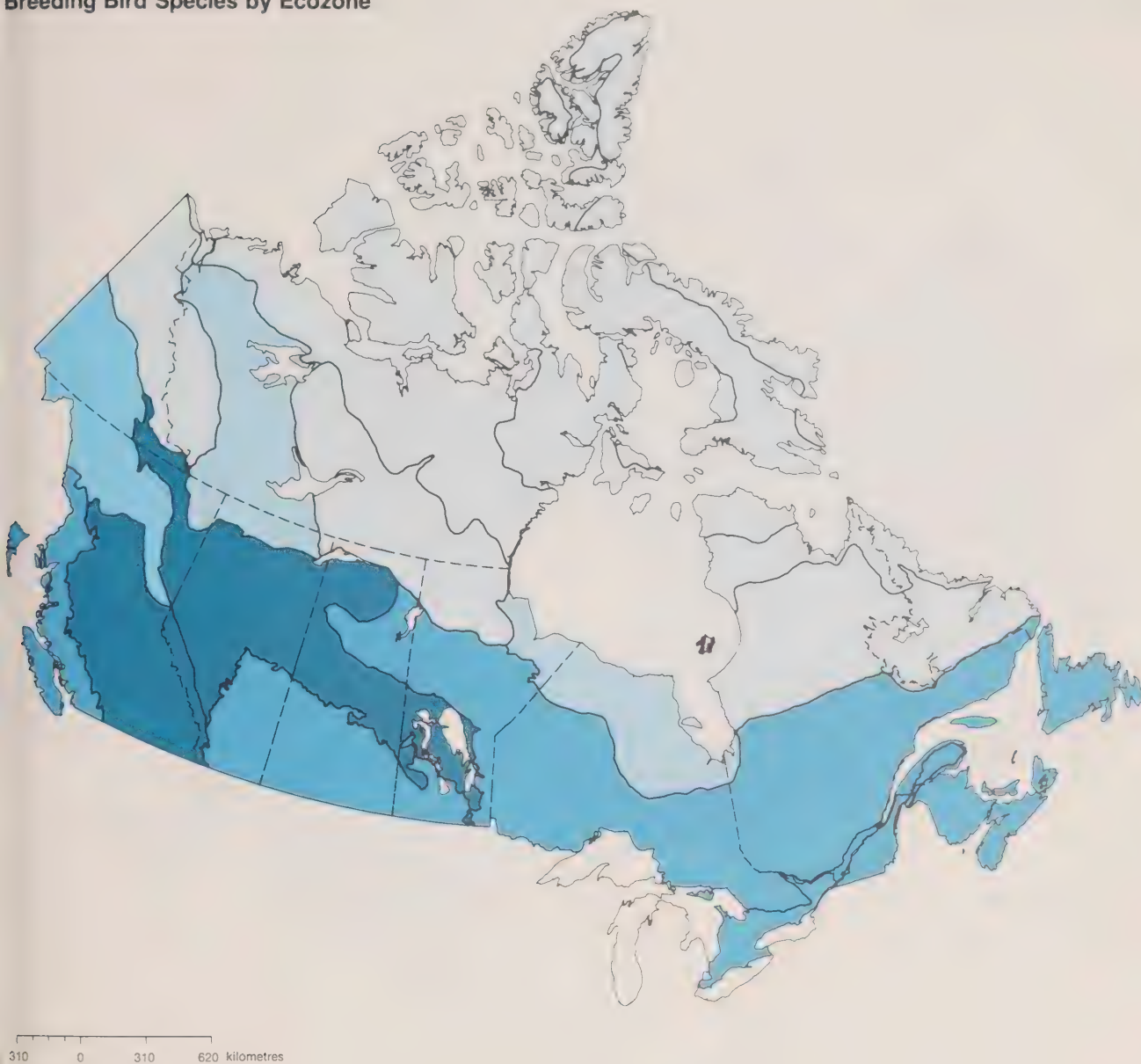
Sources:

The National Museums of Canada, *The Birds of Canada*, by W. Earl Godfrey, 1979.
Special tabulation by the Office of the Senior Adviser on Integration, Statistics Canada.

Note:

This table presents number of bird species by Order with a further breakdown to the Family level for birds of prey, shorebirds and perching birds. A complete breakdown is also available. Refer to the note accompanying Table 7.1.1 for methodology details.

Map 7.1.7
Breeding Bird Species by Ecozone



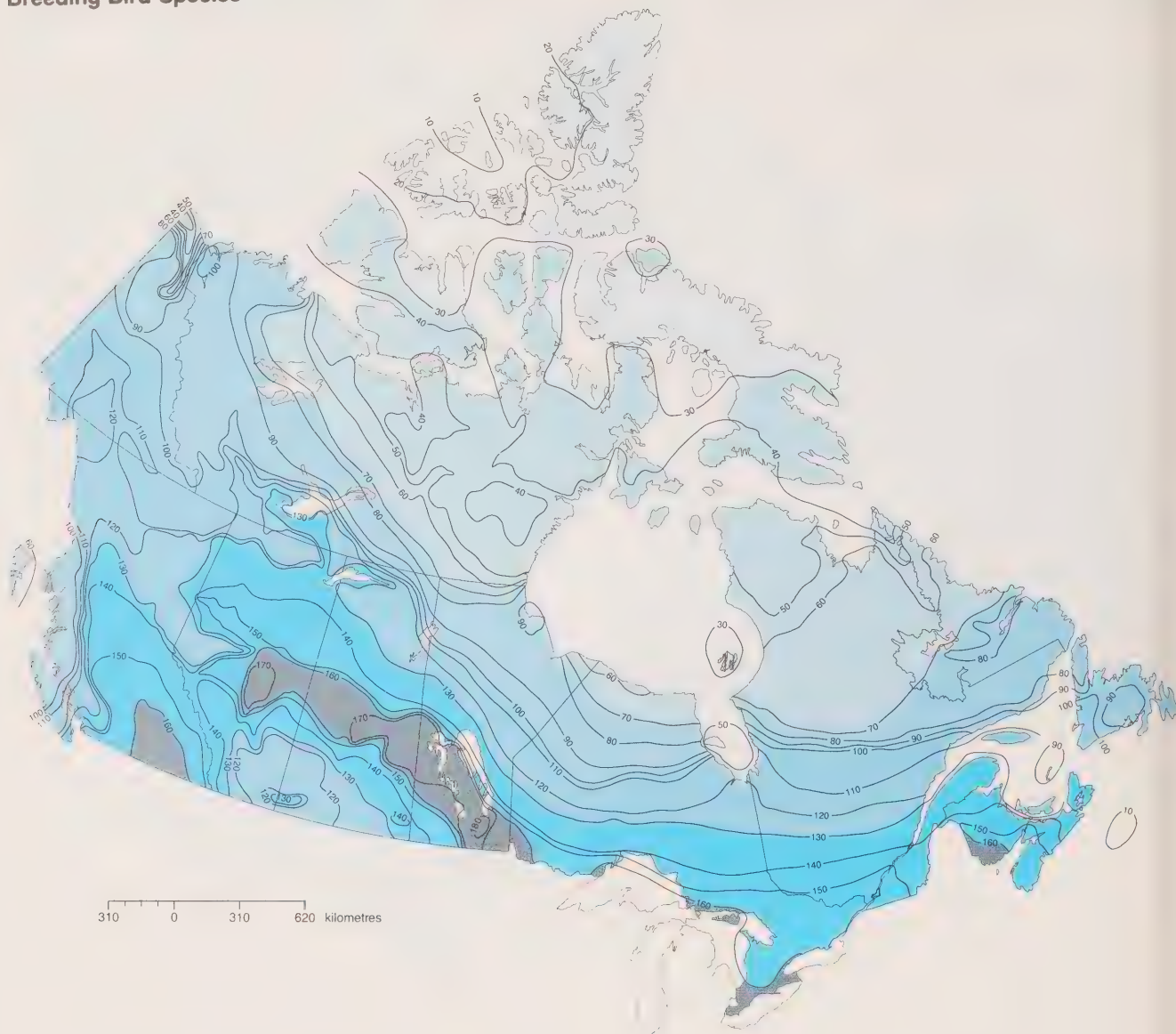
Sources:
The National Museums of Canada, *The Birds of Canada*, W. Earl Godfrey, 1979.
Special tabulations by the Office of the Senior Adviser on Integration, Statistics Canada.

Note:
Refer to Table 7.1.1 for methodology details.

Number of Species

	< 120
	120-139
	140-159
	160-179
	> 179

Map 7.1.8
Breeding Bird Species



Source:

Environment Canada, Canadian Wildlife Service, Edmonton, map by A.R. Smith, based on National Museums of Canada, *The Birds of Canada*, by W. Earl Godfrey, 1979.

Note:

This map presents information complementary to *Birds by Ecozone*, Table 7.1.6 and Map 7.1.7. In both instances Godfrey's species range maps provided the base information. In this case, however, species were counted by grid cells and the resulting patterns were generalized by plotting species isolines.

Number of Bird Species

	< 29
	30- 69
	70- 99
	100-129
	130-159
	160 +

There are 394 bird species breeding in Canada.

Map 7.1.9
Distribution of Caribou and Population of Major Herds



¹ Major herds are defined as those having an estimated population of more than 35 000 adult caribou. Data are based on transect aerial photograph counts of animals at caribou calving areas.

² Kill statistics include licensed resident, non-resident and native kill combined.

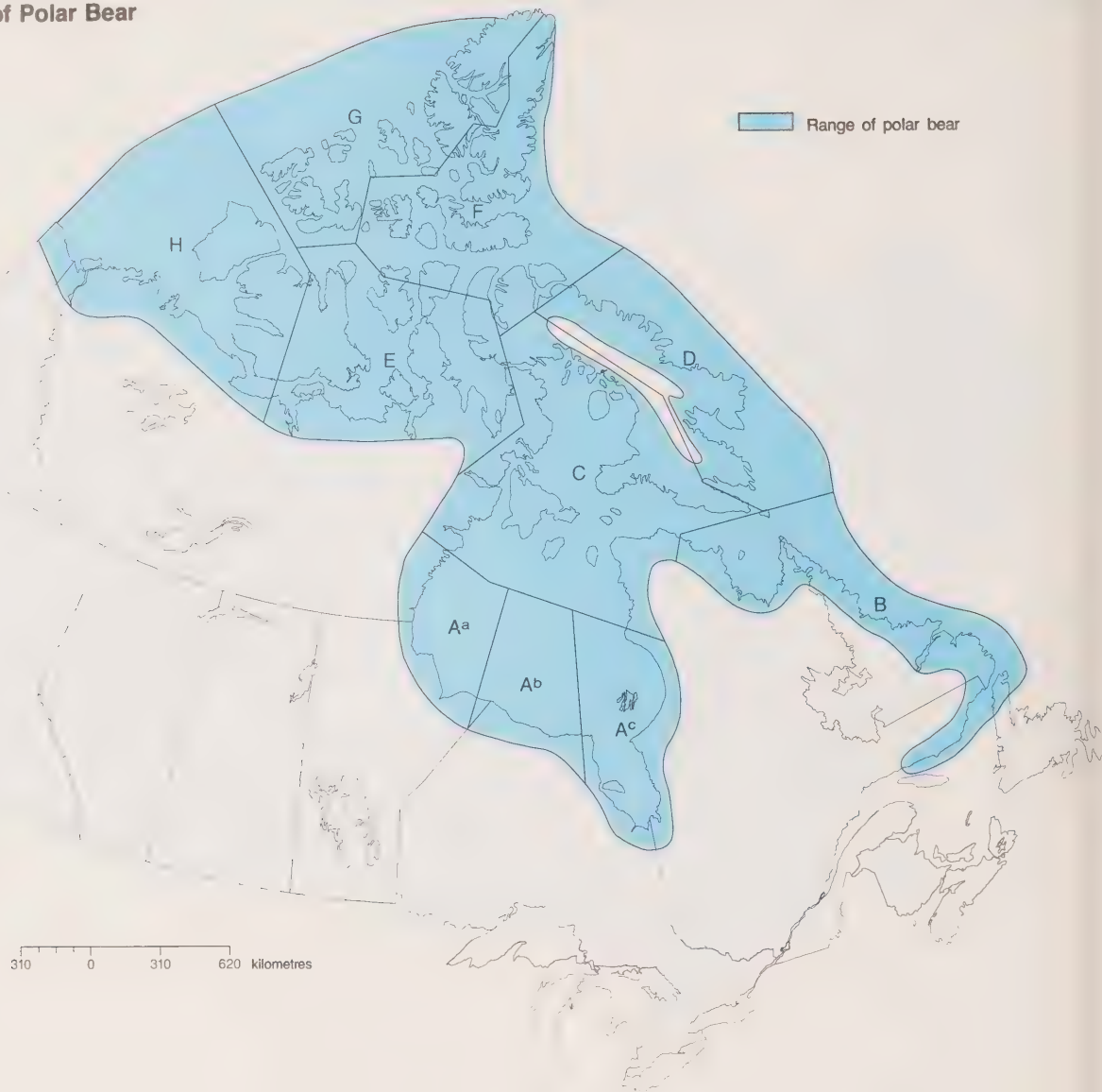
³ The Porcupine kill is Canadian kill only. Including Alaska kill the total was 2 281.

⁴ More recent estimates indicate that the population of this herd may have increased significantly (possibly to as many as 600 000 animals).

Sources:
Environment Canada, Canadian Wildlife Service, unpublished information.
Indian and Northern Affairs Canada, Northern Environment Directorate.
Government of Québec, Ministry of Recreation, Hunting and Fishing.
Government of the Northwest Territories, Department of Renewable Resources, Wildlife Service.
Government of Yukon, Department of Renewable Resources.

Major Caribou Herds			
Herd	Population Estimate ¹	Survey Year	Kill Statistics 1982-83 ²
	thousands		
1. Porcupine	110	1981	1 641 ³
2. Bluenose	40	1982	1 545
3. Bathurst	180	1982	10 350
4. Beverly	190	1982	6 030
5. Kaminuriak	230	1983	6 339
6. Wager Bay	120	1983	4 000
7. Baffin Island	45	1978	9 000
8. George River	300	1983 ⁴	10 437

Map 7.1.10
Distribution and
Population of Polar Bear



¹ Estimates are based on mark and recapture in 1981.

² Incidental kill includes: problem kill, handling death, illegal kill, unknown source of kill and natural deaths.

³ Total for sub populations A^a and A^b.

Note:

Kill and Quota statistics are for the 1982/1983 season.

Source:

Environment Canada, Canadian Wildlife Service, Edmonton, unpublished data.

Polar Bear Population Statistics

Management Zone	Population Estimate 1981 ¹	Hunting Kill	Incidental Kill ²	Hun Qu
A ^a		54	11	
A ^b	1 500-1 800 ³	15	0	
A ^c	250	35	0	
B	75	15	0	
C	..	141	6	
D	700	98	11	
E	1 100	89	11	
F	1 800-2 000	99	6	
G	..	8	0	
H	1 800	92	4	
Canada Total:	..	645	49	

Table 7.1.11
Animal Pelts Taken, 1982-83¹

Species	Newfound-land	Prince Edward Island	Nova Scotia	New Brunswick	Québec	Ontario	Manitoba	Saskatch-ewan	Alberta	British Columbia	Northwest Territories	Yukon	Canada
Badger	...	...	...	...	...	7	458	2 288	1 580	...	...	...	4 333
Black Bear	0	...	30	0	572	120	784	312	218	382	35	11	2 464
Grizzly Bear	...	...	...	...	...	...	...	...	0	12	...	...	12
Polar Bear	...	...	...	...	27	4	...	...	0	...	196	0	227
Beaver	2 777	289	2 663	4 598	54 518	141 648	24 532	35 402	54 054	11 815	2 714	701	335 711
Cougar	...	...	...	...	...	...	0	0	0	15	...	0	15
Coyote	...	...	72	797	...	2 347	9 992	19 059	37 447	3 506	29	345	73 594
Ermine	1 874	10	1 215	932	7 134	3 941	5 991	6 650	10 827	3 840	357	154	42 925
Fisher	...	...	25	124	1 267	4 413	4 585	4 537	5 055	941	57	1	21 005
Blue Fox	...	...	...	...	12	106	10	...	0	...	59	...	187
Cross or Red Fox	2 431	1 114	2 291	4 867	19 161	21 928	13 861	15 000	3 313	831	2 211	813	87 821
Silver Fox	193	49	29	...	124	...	194	123	151	...	115	0	978
Arctic Fox	25	...	...	...	285	0	1 288	75	20	...	12 652	0	14 345
Other Foxes	...	...	...	...	...	6	0	...	0	...	...	0	6
Lynx	582	...	3	...	3 289	2 888	2 059	1 613	8 315	6 264	2 200	2 320	29 533
Marten	1 338	...	...	0	18 453	58 522	3 233	2 275	10 640	23 434	17 506	4 237	139 638
Mink (wild)	4 841	635	3 622	1 654	10 033	21 575	9 910	10 581	9 585	4 110	2 768	391	79 705
Muskrat	4 837	8 527	42 929	39 136	201 252	617 459	168 047	106 835	81 985	21 580	131 109	19 339	1 443 035
Otter	818	...	450	277	3 320	10 189	1 627	976	272	429	42	50	18 450
Rabbit	...	...	0	...	...	...	243	0	0	...	...	...	243
Raccoon	...	1 336	8 511	3 555	10 669	126 636	4 090	2 856	49	667	...	...	158 369
Seal ²	X	X	X	X	X	...	...	...	...	...	14 837	...	X
Skunk	...	0	19	69	223	536	69	4	62	22	...	...	1 004
Squirrel	1 498	63	8 554	771	5 427	7 652	39 482	52 243	144 877	79 348	2 746	6 024	348 685
Bobcat	...	...	1 164	653	176	47	0	26	50	184	...	...	2 300
Wolf	26	...	...	...	3 605	1 154	424	288	611	184	523	168	6 983
Wolverine	...	...	...	...	0	26	141	22	103	265	137	336	1 030
Total	21 240	12 023	71 577	57 433	339 547	1 021 204	291 020	261 165	369 214	157 829	190 293	34 890	2 812 598

¹ Trapping season in most cases is the winter.
² Data on seal pelts taken in the Eastern Provinces are confidential as there are only two buyers; an X identifies data confidentiality.

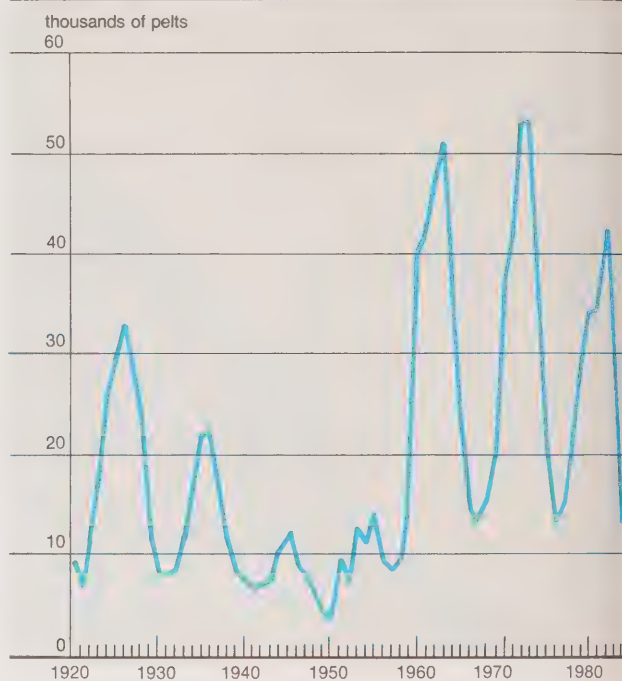
Source:
Statistics Canada, *Fur Production*, 1982-1983, Catalogue 23-207.
Note:
... indicates that species does not occur within the particular province or territory.

Chart 7.1.12
Beaver, Lynx and Muskrat Pelts Taken, 1920 to 1984

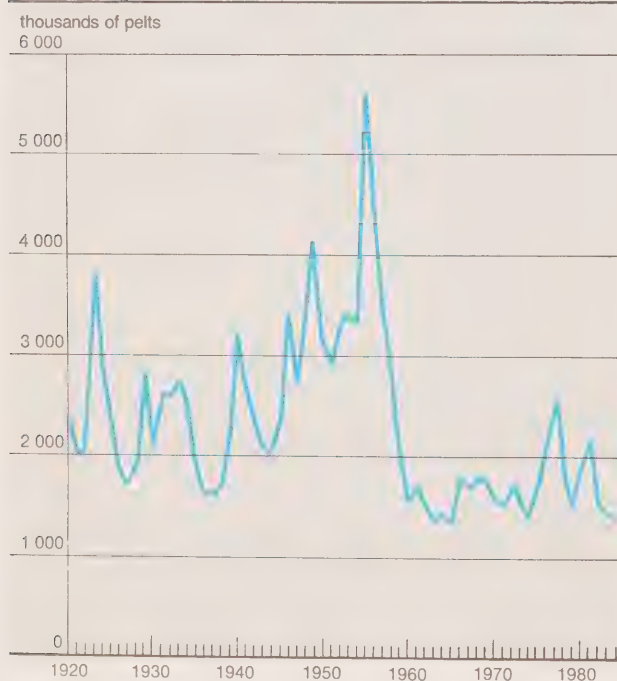
Beaver



Lynx



Muskrat



Source:

Statistics Canada, *Fur Production*, Catalogue 23-207, seasons 1919-20 to 1983-1984.

Note:

In Canada, fur harvest has been a traditional means of livelihood since the early settlement days. These data (time series since the 1920's) show great variation from year to year and apparent cycles from one decade to the next. In part this can be explained by trends in fur fashion (reflected in relative price change) and in part by the underlying population trends. Some species, like lynx, show frequent population variations due to natural factors such as availability of food source (i.e., snowshoe hare), perhaps combined with pressures from hunting. Other trends may reflect "over-harvesting" and subsequent recovery (beaver pelts taken since 1930 parallels, to some extent, the steady recovery of the underlying population). Price change (related to fashion) may be a major factor in the variation in muskrat pelts taken, although some time lags seem to exist.

Table 7.1.13

Sport and Native Hunting Kills of Large Mammals, by Province, 1983

Province	Moose	Deer	Caribou	Wapiti	Antelope	Mountain Sheep ¹	Mountain Goat	Bison ²	Bear ³	Mountain Lion	Wolf	Muskox
Newfoundland	7 444	...	4 340	...	...	...	...	0	272	...	50	...
Prince Edward Island	...	...	...	...	...	...	...	...	...	...	...	...
Nova Scotia	0	44 513	...	...	...	...	...	...	422	...	...	...
New Brunswick	1 287	27 165	...	...	...	...	...	...	801	...	...	...
Québec	11 799 ⁴	3 849 ⁴	7 052 ⁴	...	...	...	...	...	1 432 ⁴	...	0	0
Ontario	10 700 ⁴	11 955 ⁴	...	...	...	...	...	...	4 500 ⁴	...	0	...
Manitoba	4 510	35 450	185	680	...	...	...	0	1 570	0	450	...
Saskatchewan	2 113	39 805	27	471	2 010	...	...	0	1 071	0	0	...
Alberta	18 000	12 000	...	18 000	1 000	255	26	0	5 050	33	0	...
British Columbia	9 613	29 804	308	3 321	...	426	924	0	4 375	159	333 ⁴	...
Yukon	1 081	0	1 222	0	...	239	5	...	215	0	45	0
Northwest Territories	691 ⁴	...	24 740 ⁴	...	...	221 ⁴	7 ⁴	60 ⁴	803 ⁴	...	0	207 ⁴

¹ Mountain sheep includes California bighorn, Dall's sheep, Rocky Mountain bighorn, and Stone's sheep.

² Bison hunting is only permitted in the Northwest Territories.

³ Bear includes black, grizzly, and polar bear.

⁴ 1982 data.

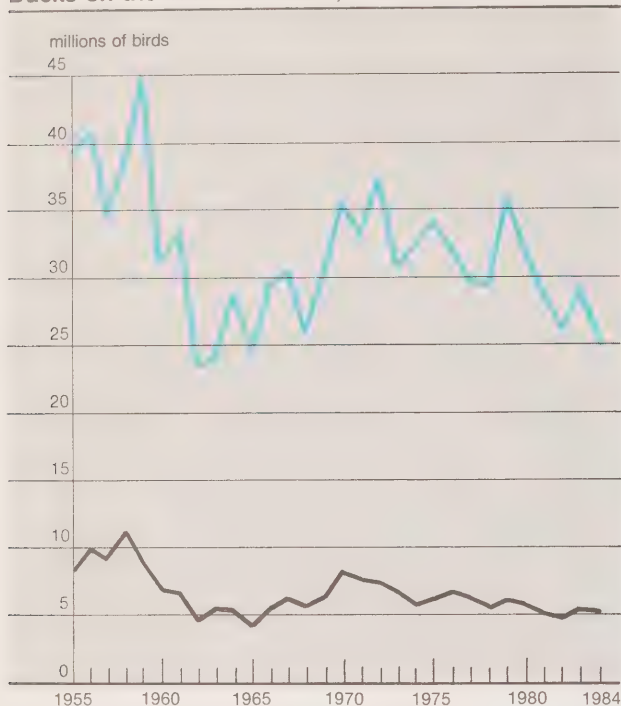
Source:

Environment Canada, Canadian Wildlife Service, and Government agencies in the Provinces and Territories responsible for wildlife.

Note:

These data are obtained from a number of different agencies and are largely estimates. Due to methodological differences some caution should be used in interpreting the figures. The data in all cases include sport hunting kills. In many cases they also include native kills. The figures for bear also include kills for the fur industry. For cougar and wolf, sport kills only are shown; additional cougar and wolves may have been killed for bounties and pelts. Québec and Yukon caribou kill data include both native and sports hunting. In Ontario and Alberta, only caribou hunting by natives is permitted and these figures are not reported. In both Manitoba and Saskatchewan only the kill of woodland caribou is reported. The kill of barren-ground animals is not available.

Chart 7.1.14

Ducks on the Western Plains, 1955 to 1984**Source:**

Environment Canada, Canadian Wildlife Service and United States Fish and Wildlife Service, Annual Waterfowl Breeding Population Survey.

Note:

Duck population estimates are derived from the Annual Waterfowl Breeding Population Survey which is taken annually by the United States Fish and Wildlife Service in cooperation with the Canadian Wildlife Service. The insert map outlines the survey area in Canada. The pond count shown in Graph 7.1.15 is also taken by this survey but restricted to the Prairies. The graphs illustrate the variability of

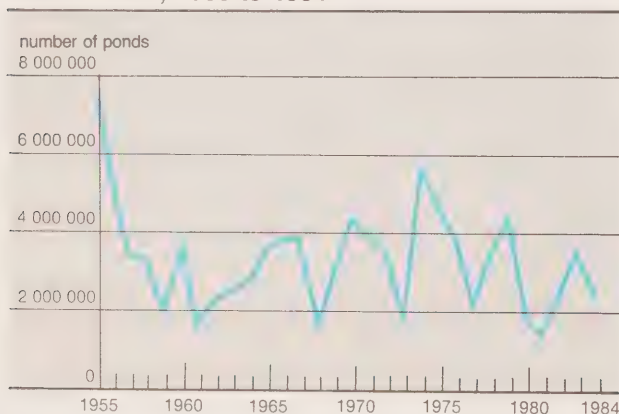
**Area of Waterfowl Breeding Population Surveys**

— All ducks
— Mallards

the duck population and the number of ponds. Ponds are critical habitat for breeding ducks and duck populations correlate closely with the number of ponds.

The survey monitors populations of nineteen species. Dabbling ducks in the survey are: mallard, black duck, gadwall, wigeon, green-winged and blue-winged teal, shoveler and pintail. Diving ducks included in the survey are redhead, canvasback, scaup, ring-necked, golden-eye and bufflehead. Miscellaneous ducks counted are old squaw, eider, scoter, ruddy duck and merganser. Coot are also counted although they are not ducks.

Chart 7.1.15

Prairie Ponds, 1955 to 1984**Source:**

Environment Canada, Canadian Wildlife Service and United States Fish and Wildlife Service, Annual Waterfowl Breeding Population Survey.

Table 7.1.16

Migratory Birds Killed¹, by Province, 1983

	Woodcock	Common Snipe	American Coot	Sandhill Crane	Mourning Dove	Band-tailed Pigeon	Ducks	Geese	Total
thousands									
Newfoundland	...	15.2	...	...	...	...	119.5	13.7	148.4
Prince Edward Island	0.7	0.2	...	...	...	...	36.1	15.7	52.8
Nova Scotia	3.4	2.1	...	...	...	...	117.3	9.7	132.5
New Brunswick	7.3	1.5	...	...	...	...	72.9	7.5	89.2
Québec	36.9	25.4	9.1	...	...	...	454.0	83.8	609.1
Ontario	55.7	8.0	3.8	...	...	...	888.4	72.7	1 028.5
Manitoba	...	1.5	1.3	0.4	...	...	284.4	158.6	446.1
Saskatchewan	...	1.1	2.0	2.7	...	...	381.7	210.1	597.7
Alberta	...	8.4	3.9	...	...	...	515.7	122.8	650.9
British Columbia	...	3.5	0.3	...	1.0	3.8	193.5	15.6	217.7
Yukon	...	...	...	...	...	...	13.0	2.7	15.8
Northwest Territories	...	...	...	...	...	...	3.0	0.4	3.3
Canada	103.9	66.9	20.4	3.1	1.0	3.8	3 079.5	713.3	3 991.9

¹ Estimates are based on the results of the National Harvest Survey (NHS). Questionnaires are mailed to purchasers of Canada migratory game bird hunting permits; thus other kills such as native hunting, illegal kills and subsequent deaths of injured birds are not included in these figures.

Source:

Environment Canada, Canadian Wildlife Service, 1984.

Note:

Individual items may not add to totals due to rounding.

Table 7.1.17

Waterfowl¹ Killed², by Province, 1967 to 1983³

Year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Québec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon	Northwest Territories	Total
thousands													
1967	73.9	27.2	74.7	50.0	356.0	1 091.2	394.3	555.6	780.2	394.6	..	..	3 797.8
1968	67.2	27.6	81.4	66.7	361.2	828.9	316.4	365.9	518.6	387.7	..	..	3 021.6
1969	99.0	32.7	71.2	69.2	538.6	995.0	505.3	623.5	861.9	293.1	..	..	4 089.4
1970	105.6	39.4	84.3	66.9	553.3	930.5	565.9	1 062.3	1 005.1	304.8	..	..	4 717.9
1971	79.5	42.5	106.8	64.2	560.3	803.4	389.3	781.3	926.7	242.6	..	..	3 996.5
1972	97.4	30.8	83.7	60.0	466.5	858.2	421.0	706.5	894.7	273.3	..	..	3 892.1
1973	119.2	25.1	123.7	55.1	547.0	793.8	341.3	588.8	933.6	267.4	..	..	3 795.1
1974	112.1	42.7	110.6	61.8	623.3	859.1	338.1	790.7	1 107.5	225.5	..	..	4 268.4
1975	109.8	34.8	127.4	62.0	520.1	989.1	451.6	964.4	971.2	249.0	5.4	11.2	4 496.2
1976	106.9	55.6	128.8	75.1	656.1	1 026.8	450.8	955.8	999.2	242.7	4.1	30.9	4 733.0
1977	145.4	48.8	143.4	56.3	703.2	980.1	335.5	630.3	894.6	270.6	3.2	21.3	4 233.0
1978	155.7	41.9	116.4	69.1	637.6	1 007.7	485.4	665.8	689.6	223.1	3.4	20.4	4 116.2
1979	135.8	31.5	94.5	51.7	540.0	921.5	579.1	735.1	784.1	221.5	3.5	10.5	4 108.8
1980	116.9	50.8	133.2	63.0	623.3	998.1	505.3	614.9	822.0	205.0	3.6	12.5	4 148.5
1981	124.4	40.6	121.2	63.3	563.8	902.9	441.7	414.6	651.1	208.1	1.8	5.0	3 538.6
1982	131.8	53.1	93.0	63.3	586.1	934.3	437.6	475.1	578.1	180.7	1.1	3.1	3 537.4
1983	133.2	51.8	127.1	80.4	537.8	961.1	443.0	591.9	638.6	209.0	3.3	15.7	3 792.9

¹ Waterfowl refers to ducks and geese only.

² Estimates are based on the results of the National Harvest Survey (NHS). Questionnaires are mailed to purchasers of Canada migratory game bird hunting permits; thus other kills such as native hunting, illegal kills and subsequent deaths of injured birds are not included in these figures.

³ The Survey was first taken in 1966 and was expanded to include Yukon and the Northwest Territories after 1974.

Source:

Environment Canada, Canadian Wildlife Service, 1984.

Note:

Individual items may not add to total due to rounding.

Table 7.1.18
Mammal Species in Jeopardy

Species	Status	Critical Habitat	Comments	Probable Stress/Limiting Factors
Vancouver Island Marmot	endangered	alpine and subalpine areas, steep slopes, talus debris, open meadows	total population between 50 and 100 animals, long-term population decline	loss of habitat
St. Lawrence Beluga	endangered	St. Lawrence Estuary	long-term declining population, reduced range	hunting, human disturbance — movement of ships, commercial fishing, loss of habitat — dredging, port and marine development, dam construction, dumping, resource exploration, pollutants and contaminants — chemical and thermal
Humpback Whale	threatened	waters of Canada's east and west coast	officially protected from commercial whaling since 1955	hunting — although protected, native kill unknown, loss of food source — availability of primary food, capelin, affected by fisheries
Bowhead Whale	endangered	winter: southern edge of pack-ice	long-term population decline, only 2,300 animals remain	hunting — commercially overharvested
Right Whale	endangered	coastal waters of both coasts of North America, from tropics to the subarctic	long-term population decline, only 100-200 animals remain	hunting — commercially overharvested
Swift Fox	extirpated	native prairie	extirpated since the 1930's, serious decrease in North American range, re-introduction programs underway	hunting — overharvested as a furbearer, pest control program — secondary poisoning from wolf control, loss of habitat
Long-tailed Weasel (<i>M.f. longicauda</i>)	threatened	aspen parkland of prairies	population decline over the past 50 years	loss of habitat — agricultural activities, loss of food source — decreased numbers and diversity of prey species
Black-footed Ferret	extirpated	native prairie	very dependent on its major prey, the prairie dog	loss of food source
Sea Otter	endangered	Pacific Coast	wiped out in Canada by the 1930's, re-introduced to coastal waters of Vancouver Island, stable population at present	hunting — commercially overharvested
Eastern Cougar (Mountain Lion) (<i>F.c. cougar</i>)	endangered	mixed and coniferous forests	long-term population decline	hunting, loss of food source — limited deer populations, human disturbance
Peary Caribou	threatened	Arctic Islands (except Baffin) summer: forage slopes of river valleys and upland plains winter: beach ridges	extreme variability in population	hunting, climatic vulnerability
Woodland Caribou (Dawson)	extinct	Queen Charlotte Islands		hunting
(Maritime)	threatened	Gaspé region, upland forest	now protected in a provincial park	loss of habitat — unsuitable habitat threatens herd viability and amplifies effects of other stresses hunting, disease — parasite infections
Wood Bison	endangered	summer: upland prairies, open forests and sand ridges winter: near lakes	long-term population decline has been reversed, re-introduction programs are providing protected ranges	hunting, disease

Sources:

Environment Canada, Canadian Wildlife Service, Committee on the Status of Endangered Wildlife in Canada, various status reports.

N. Novakowski, Environment Canada, Canadian Wildlife Service, unpublished information.

C.G. von Zyll de Jong, National Museums of Canada, unpublished information.

Note:

Species status refers to the degree to which a species is in jeopardy. COSEWIC recognizes a number of degrees of danger to species. Definitions for the ones presented in this table and Tables 7.1.19, 7.1.20 and 7.1.21 are as follows:

THREATENED SPECIES: Any indigenous species of fauna or flora that is likely to become endangered in Canada if the factors affecting its vulnerability do not become reversed.

ENDANGERED SPECIES: Any indigenous species of fauna or flora whose existence in Canada is threatened with immediate extinction through all or a significant portion of its range, owing to the action of man.

EXTIRPATED SPECIES: Any indigenous species of fauna or flora no longer existing in the wild in Canada but existing elsewhere.

EXTINCT SPECIES: Any species of fauna or flora formerly indigenous to Canada but no longer existing anywhere.

The complete COSEWIC list is presented as Appendix Table 7.1.

Table 7.1.19
Bird Species in Jeopardy

Species	Status	Critical Habitat	Comments	Probable Stress/Limiting Factors
White Pelican	threatened	breeding: remote, inaccessible islands	long-term population decline	human disturbance
Peregrine Falcon (<i>tundrius</i>)	threatened	breeding: tundra region, nesting: cliffs	long-term population decline	pollution and contaminants — DDE residues leading to reproductive failure (egg shell thinning) human disturbance — egg collectors, taking of young for falconry, hunting, loss of habitat
(<i>anatum</i>)	endangered	breeding: taiga region, nesting: cliffs	almost extirpated	
Ferruginous Hawk	threatened	open grasslands	greatly reduced breeding distribution	loss of habitat, loss of food source — decrease in prey
Greater Prairie Chicken	endangered	open, undisturbed native grasslands	almost extirpated	loss of habitat
Whooping Crane	endangered	breeding: generally Wood Buffalo National Park	long-term population decline, now stable but small population	hunting — accidental shooting, loss of habitat
Piping Plover	endangered	breeding: on ocean beaches or along inland lakes and sloughs	generally uncommon, periodic population declines	hunting, human disturbance
Eskimo Curlew	endangered	breeding: tundra and lichen woodland	almost disappeared between 1880 and 1895	human disturbance, hunting, habitat loss
Burrowing Owl	threatened	heavily grazed pastures	long-term population decline	human disturbance, pollution and contaminants — insecticides, pesticides, loss of habitat — land development
Kirtland's Warbler	endangered	dense jack-pine stands	long-term population decline, now seems to be stabilized	loss of habitat, introductions — nest parasitism (brown-headed cowbird)
Henslow's Sparrow	threatened	open fields and meadows, breeds in southern Ontario	population decline during the past 30 years	loss of habitat — land development

Sources:
Environment Canada, Canadian Wildlife Service, Committee on the Status of Endangered Wildlife in Canada, various status reports.
National Museums of Canada, unpublished information.

Note:
Refer to note accompanying Table 7.1.18 for an explanation of species status.

Table 7.1.20
Fish and Reptile Species in Jeopardy

Species	Status	Critical Habitat	Comments	Probable Stress/Limiting Factors
Acadian Whitefish (fish)	endangered	Tusket and Petit rivers in southern Nova Scotia	less than 500 specimens in the Petit River	fishing — were commercially exploited, human disturbance — development (ie. hydro-electric dam, fish ladders) led to easier capture, pollution and contaminants — acidification of habitat due to acid rain
Shorthead Sculpin (fish)	threatened	found only in the Flathead River in southeastern British Columbia	very small population	pollution and contaminants — run off from coal mines contributes to stream turbidity and acidity which affect reproductive success
Longjaw Cisco (fish)	extinct	formerly abundant in Lakes Michigan and Huron, small population was also found in Lake Erie	none have been caught since 1968	fishing — intensive fishing pressure and sea lamprey predation
Blue Walleye (fish)	extinct	formerly occurred in Lake Erie, lower Niagara River and western Lake Ontario	none have been caught since the 1960s, historically, this species was of great importance in commercial and sport fishery	fishing — intensive fishing pressure, competition — interspecies competition and predation on young fish, loss of habitat — eutrophication of the bottom waters forced fish into deeper waters of eastern basin of Lake Erie, species were highly dependent on sight for prey capture and this became impeded as water clarity declined.
Gravel Chub (fish)	endangered	Thames River drainage basin, prefers clear to moderately turbid streams with consistent flow	none have been caught since 1958, peripheral species in Canada	loss of habitat — due to siltation of gravel-bottomed rivers and streams, possibly due to human development.
Leatherback Turtle (reptile)	endangered	marine beaches which serve as nesting areas	designated endangered in Canada because of similar international status	predation

Sources:

Environment Canada, Canadian Wildlife Service, Committee on the Status of Endangered Wildlife in Canada.
National Museums of Canada, unpublished information.

Note:

Refer to note accompanying Table 7.1.18 for an explanation of species status.

Table 7.1.21
Plant Species in Jeopardy

Species	Status	Distribution	Comments	Probable Stress/Limiting Factors
Furbish's Lousewort (<i>Pedicularis furbishiae</i>)	endangered	banks of the upper Saint John River, New Brunswick	herb, about 600 plants remain in Canada	loss of habitat — destruction of riverside areas by farming, forestry, industrial operations, flooding, and hydro-electric projects
Small White Lady's Slipper (<i>Cypripedium candidum</i>)	endangered	tall grass prairie, fens, swampy meadows, remnant prairies, edge of thickets	orchid, long-term decline throughout its range	loss of habitat — agricultural and urban development
Tyrell's Willow (<i>Salix planifolia</i> ssp. <i>tyrellii</i>)	threatened	beach dunes and active sand dunes, only found on the south shore of Lake Athabasca, Saskatchewan	herb, very limited distribution, species unique to Canada	loss of habitat — threatened by proposed road development between Lake Athabasca and Cluff Lake uranium mines; pollution and contaminants — acid rain from tar sands operations in Alberta (plants grow in calcium-poor sand dunes)
Athabasca Thrift (<i>Armeria maritima</i> ssp. <i>interior</i>)	threatened	three localities in Canada (on the south shore of Lake Athabasca, Saskatchewan), restricted to relatively stable ridges and plains comprised of glacial till covered by a veneer of gravel (also grows in moist depressions between active sand dunes)	herb, very limited distribution, species unique to Canada	loss of habitat — threatened by proposed road development between Lake Athabasca and Cluff Lake uranium mines; pollution and contaminants — acid rain from tar sands operations in Alberta
Small Whorled Pogonia (<i>Isotria medeoloides</i>)	endangered	one site in Elgin County, Ontario	the rarest orchid in northeastern U.S. and Canada, only 2 plants in Ontario (1980)	human disturbance — rarely attracts attention, loss of habitat
Kentucky Coffee Tree (<i>Gymnocladus dioica</i>)	threatened	in Canada exists only in southern-most Ontario	used as an ornamental	loss of habitat
Blue Ash (<i>Fraxinus quadrangulata</i>)	threatened	southern Ontario	largest population is 200 trees on Pelee Island	loss of habitat — land clearing, especially flood plain forests; human disturbance — grazing in seedling areas has affected reproduction
Southern Maidenhair Fern (<i>Adiantum capillus-veneris</i>)	endangered	Fairmont Hot Springs, B.C.	plant size, number of plants and sites are decreasing	loss of habitat — reduced hot water flow and increased competition from herbaceous species
Plymouth Gentian (<i>Sabatia kennedyana</i>)	threatened	gravelly, peaty margins of lakes in the lowest portions of the Tusket River valley, Yarmouth County, Nova Scotia	herb, apparently intolerant of competition	human disturbance — reservoir construction has changed water levels; cottage development
Pink Coreopsis (<i>Coreopsis rosea</i>)	endangered	found only in Tusket River Valley, Nova Scotia, restricted to gravelly margins of lakes	herb, range has decreased significantly since the 1930's	human disturbance — increased cottage development and use of off-road vehicles

Table 7.1.21
Plant Species in Jeopardy (concluded)

Species	Status	Distribution	Comments	Probable Stres/Limiting Factors
American Water-Willow (<i>Justicia americana</i>)	threatened	occupies the flood plains of streams in Ontario and Québec	aquatic plant (herb)	climatic vulnerability — at northern limits of its range; pollutants and contaminants — industrial pollutants; loss of habitat — land development; natural competition — alligator grass
Giant Helleborine (<i>Epipactis gigantea</i>)	threatened	four localities in southern British Columbia, Fairmont Hot Springs has the largest population	orchid	human disturbance — reduction of run-off from hot springs
Pink Milkwort (<i>Polygala incarnata</i>)	endangered	prairies and meadows, found at only two sites in Lambton County, Ontario	herb, only about 100 plants left, previously common at one of the sites	loss of habitat — expansion of agricultural land use
Mosquito Fern (<i>Azolla mexicana</i>)	threatened	four localities in Canada, all within a thirty five square kilometre area on the south side of Sushwap Lake, British Columbia	requires fluctuating water levels and thrives within a relatively narrow range of water chemistry, under suitable conditions reproduces rapidly to form millions of plants within weeks	pollutants and contaminants — potential chemical and oil spills, road salt effects
Cucumber Tree (<i>Magnolia acuminata</i>)	endangered	limited distribution in southwestern Ontario, nine sites	rapid decline in populations has occurred, only a few seed bearing trees remain	human disturbance — decline due mainly to lumbering and forest clearing
Heart-Leaved Plantain (<i>Plantago cordata</i>)	endangered	moist depressions in undisturbed, shaded, deciduous woodland, one site remains extant in Canada on the eastern shore of Lake Huron	plantain, approximately 300 plants remain on Canadian site, reduced population throughout North American range	loss of habitat — development; human disturbance — collecting by natives for medicinal purposes
Eastern Prickly Pear Cactus (<i>Opuntia humifusa</i>)	endangered	restricted to four confirmed locations in southeastern Ontario	cactus	loss of habitat — changes in vegetation cover, agricultural expansion; human disturbance — collecting
Bluehearts (<i>Buchnera americana</i>)	threatened	found only on a narrow stretch of Lake Huron's shoreline in Lambton County, Ontario	herb, approximately 2200 plants (1981)	loss of habitat — cottage development
Water Pennywort (<i>Hydrocotyle umbellata</i>)	endangered	found in only two localities in southeastern Nova Scotia - Wilson's Lake and in Kejimikujik Lake	small creeping aquatic plant of tropical origin, reaches northern limit of its range in Canada	loss of habitat — cottage development aquatic recreation activities

Sources:

Environment Canada, Canadian Wildlife Service, The Committee on the Status of Endangered Wildlife in Canada, *Status Reports*.
 Dr. E. Haber, National Museums of Canada, Botany Division, unpublished information.

Note:

Refer to Table 7.1.18 for a discussion of status.

Table 7.1.22
Non-Native¹ Mammal Introductions

Species	Introduction Where/When	Origin	Status	Intentional or Accidental Release
European Hare	nine animals escaped from captivity at Brantford, Ontario in 1912, intentional introductions at Fort William, Ontario in the 1940's	Germany	well established in Southern Ontario, unsuccessful in more northern areas	accidental and intentional
Snowshoe Hare	Newfoundland in 1864, Anticosti Island, Québec, 1902-03	Canadian mainland	established on both islands	intentional
Masked Shrew	Newfoundland in 1958 for larch sawfly control	Canadian mainland	spread over much of the island	intentional
Eastern Fox Squirrel	Pele Island, Ontario, about 1890	Ohio	firmly established and common in areas of suitable habitat	intentional
Black Rat	coastal B.C., arrived with early settlement	southern Asia	well established in settled areas, seaports	accidental
Alexandrian Rat	Queen Charlotte Islands, and lower B.C. mainland, arrived with settlers from the orient	Asia	well established	accidental
Norway Rat	around 1775	Europe, Asia	found in most settled areas of Canada	accidental
House Mouse	arrived with first Europeans	Europe, Asia	found in most settled areas of Canada	accidental
Nutria (Coypu)	Fraser River delta, B.C., Ottawa River drainage of west Québec and eastern Ontario	South America	introduced to North America as a ranch fur-bearer, escaped animals established feral populations, cold climate restricts their range in Canada	intentional and accidental
Sea Otter	Burnaby Island, B.C., 1969 (native to B.C. Coast but extirpated around 1900)	Alaska	status is uncertain	intentional
Reindeer	Newfoundland, 1907, (mainland in 1918) Rocky Bay, Québec, 1918, later to Anticosti Island Great Slave Lake area, NWT, 1911 Mackenzie River delta, 1935	Norway, Alaska	unsuccessful on Anticosti Island, and in Great Slave Lake area, Mackenzie delta herd remains strong	intentional
Moose	Newfoundland in 1878 and 1904, Cape Breton Island, Nova Scotia in 1947 and 1948, Anticosti Island, Québec, early 1900's, Southern Labrador in 1953	Canadian range	flourishing in Newfoundland	intentional
Red Deer	British Columbia, 1913	New Zealand	unsuccessful, population decline began in 1940's	intentional
Fallow Deer	James Island, B.C., about 1895 (other releases on different islands, early 1900's)	Mediterranean Region and Asia	successful, flourishing on James, Saltspring, and Sidney Islands, B.C.	intentional
White-tailed Deer	Anticosti Island in 1896, Prince Edward Island in 1949	Canadian mainland	flourishing on Anticosti Island, surviving on Prince Edward Island	intentional

¹ Non-native species are those introduced into an area outside their natural range. This includes from one location to another within the same country. Only the major introductions of this latter type are listed here.

Sources:
 Environment Canada, *Exotic Mammals and Birds in Canada — An Historical Review*, by N. Novakowski, G. Moore, P. Reilly, 1975 (unpublished)
 National Museums of Canada *The Mammals of Canada*, by A.W.F. Banfield, 1977.

Table 7.1.23
Non-Native Bird Introductions

Species	Introduction Where/When	Origin	Status	Intentional or Accidental Release
Northern Japanese Green Pheasant	Prince Edward Island	Japan	unsuccessful release	intentional
Ring-Necked Pheasant	Newfoundland, near St. John's, 1950's (escaped from commercial poultry establishment), New Brunswick, Prince Edward Island and Ontario, 1900, Manitoba, 1950's, Saskatchewan, 1940's, British Columbia, many releases between 1882 and 1960, Yukon, 1950's	Asia	established in St. John's area, Maritime introductions surviving, successfully established in Ontario, some surviving in Manitoba, successfully established in southern British Columbia and the Queen Charlotte Islands, unsuccessful in Yukon	Newfoundland release accidental, others intentional
Coturnix Quail	Québec, 1875 and 1932, Ontario, 1875 and recently	Italy	last sighted in Québec in 1947, present status unknown	intentional
California Quail	near Victoria, B.C., 1860 and 1870's, Vancouver Island and mainland B.C., 1890's, other areas of B.C., early 1900's	western U.S.A.	well established on Vancouver Island but populations are relatively low	intentional, natural migration
Mountain Quail	Victoria, B.C., 1860-61, other releases in Fraser Valley, Vancouver Island 1870-1880's	western U.S.A.	small populations established on Vancouver Island	intentional
Gray Partridge	Prince Edward Island, 1930, Nova Scotia, 1926, New Brunswick, 1926, southwestern Québec and Ontario, late 1930's, Manitoba, Saskatchewan and Alberta, 1908, southern interior of B.C., 1904	Czechoslovakia, Hungary	generally successful except in New Brunswick	intentional
Chukar Partridge	Prince Edward Island and New Brunswick, southern B.C., 1950-55 southern Saskatchewan and Manitoba, 1938	U.S.A.	Maritime introduction unsuccessful, British Columbia population established, few birds surviving in the Prairies	intentional
Wild Turkey	Maritimes, Prairies, West Coast, and southern Ontario	U.S.A. (Canadian species extirpated by 1902 due to habitat loss)	reintroduction attempts have been made in its former Canadian range	intentional
Rock Dove (Pigeon)	1906	Europe	very common across southern Canada, mainly around human settlements	intentional
English Skylark	near Victoria, B.C., 1903 and 1913	Europe	well established	intentional
Common Starling	introduced to North America at New York in 1890, spread to Canada by 1914	Europe	established across Canada by 1950	intentional
Crested Mynah	Vancouver, B.C. in 1897	Orient	established in the Vancouver area	accidental
House Sparrow	New York in 1850, first Canadian releases in Québec and Halifax	England	established across Canada by 1890	intentional

Sources:

Environment Canada, *Exotic Mammals and Birds in Canada — An Historical Review* by N. Novakowski, G. Moore, P. Reilly, 1975 (unpublished).
National Museums of Canada, *The Birds of Canada* by W. Earl Godfrey, 1979.

Table 7.1.24
Exotic¹ Fish Introductions²

Species	Introduction Where/When	Natural Distribution	Status	Intentional or Accidental Release
Danube Salmon (<i>Hucho hucho</i>)	Québec in 1969	Czechoslovakia (Danube River)	unsuccessful introduction	intentional for sport fishing
Cherry Salmon (<i>Oncorhynchus masou</i>)	Algonquin Park, Ontario in 1965	Japan (Shirbetsu River)	unsuccessful introduction	intentional for sport fishing
Golden Trout (<i>Salmo aquabonita</i>)	British Columbia in 1959, also in Alberta	Wyoming	established	intentional for sport fishing
Brown Trout (<i>Salmo trutta</i>)	Newfoundland in 1884-1886, 1892, 1905, Nova Scotia in 1925, New Brunswick in 1921, Québec in 1890, 1951, Ontario in 1913-1918 and other years, Manitoba various years since 1943, Saskatchewan and Alberta in 1924, B.C. beginning in 1932 ending in 1961.	Europe	established; in some cases they have displaced native trout as dominant species	intentional for sport fishing
Alaska Blackfish (<i>Dallia pectoralis</i>)	southern Ontario in 1956	Alaska	unsuccessful introduction	intentional
Goldfish (<i>Carassius auratus</i>)	throughout Canada	eastern Asia	surviving, in some cases common, hybridization with carp	deliberate illegal introductions and accidental releases
Common Carp (<i>Cyprinus carpio</i>)	Ontario in 1880 and 1891, Manitoba in 1885, 1886, 1889, B.C. in 1970's	Asia and Europe	established and abundant, competes with native species	intentional and accidental releases
Mosquito fish (<i>Gambusia affinis</i>)	Manitoba in 1958, B.C. in 1928, Alberta (Banff) in 1924	U.S.A.	established in Alberta, unsuccessful elsewhere	intentional, mosquito control experiment
European Flounder (<i>Platichys flesus</i>)	Lake Erie, Lake Superior	Europe	unknown	accidentally released from ballast water of European ships

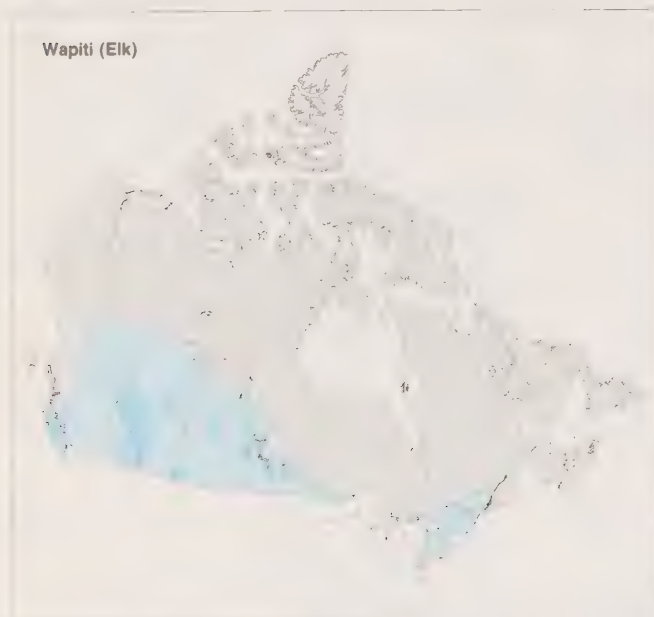
¹ Exotic species are any introduced by man from another country.

² This table details introductions of fish from outside Canada. A number of species, however, have been introduced to new ranges within Canada by man's action. The population of the upper Great Lakes by the Lamprey as a result of the construction of the Welland Canal is perhaps the best known example of this. Another is the introduction of West Coast salmon species to the Great Lakes. In addition to the introductions listed here there have been very localized releases of exotics. The hot springs of Banff National Park in Alberta, for example, have been the habitat at various times to a host of tropical species including Guppies, Swordtails, Jewelfish and Cichlids released by aquarists.

Source:

E.J. Crossman, "Introduction of Exotic Fishes to Canada" Chapter 5 in *Distribution, Biology and Management of Exotic Fishes*, edited by W. Courtenay and J. Stauffer, Jr., The John Hopkins University Press, Baltimore, 1984.

Map 7.1.25

Range Change of Selected Species

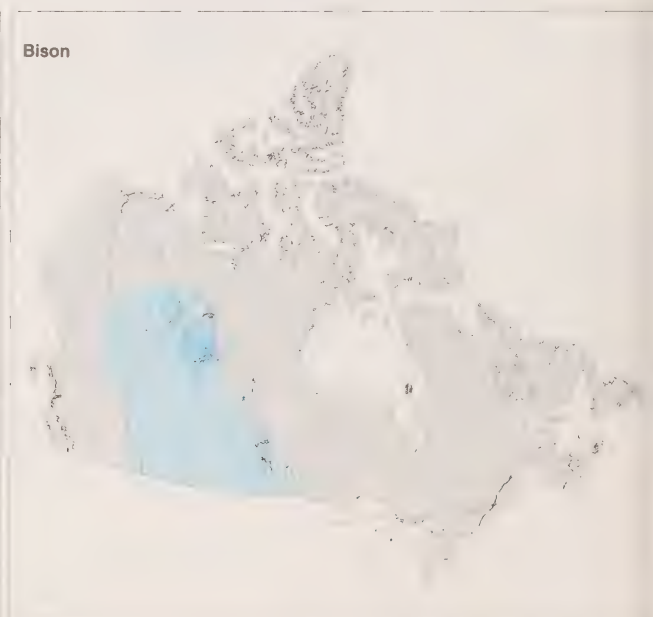
Source:
The National Museums of Canada, *The Mammals of Canada*,
by W.F. Banfield, 1977.



Source:
Environment Canada, Committee on the Status of Endangered
Wildlife in Canada, *Grizzly Bear Status Report*, 1984.



Source:
Environment Canada, Committee on the Status of Endangered
Wildlife in Canada, *Wolverine Status Report*, 1984.



Source:
The National Museums of Canada, *The Mammals of Canada*, by
W.F. Banfield, 1977.

Map 7.1.25
Range Change of Selected Species



Source:
The National Museums of Canada, *The Mammals of Canada*, by
W.F. Banfield, 1977.



Sources:
Environment Canada, Lands Directorate, *Canada's Special Resource Lands*,
by Wendy Simpson-Lewis, *et al.*, 1979.



Source:
Environment Canada, Lands Directorate, *Canada's Special Resource Lands*,
by Wendy Simpson-Lewis, *et al.*, 1979.

Present range
Historic range

7.2

Contaminants and Biotic Response

Introduction

The data in this section are selected examples of a growing body of quantitative evidence collected by scientists about the impact of pollutants. These data differ from those found in other sections of the publication since they constitute direct measures of *environmental response* to stress from human activity. Three concerns are examined. There is a section on contaminants in biota in the Great Lakes watershed, a presentation of mercury levels in Canadian fish and an example of the biotic response to acid rain in Nova Scotia rivers. (The reproductive failure of Atlantic Salmon).

These data do not necessarily reflect national conditions, being largely obtained from monitoring programs in areas where there is a high exposure to pollutants (eg. the Great Lakes). The high cost of measuring (due to the complex laboratory tests required) precludes a sampling approach based on large sample sizes. In cases where the variation in a population has been determined, the necessary sample size can be calculated and may be quite small. Monitoring programs are now able to identify trends of some known contaminants and identify previously unrecognized ones (see Technical Box 7.2.1). Other chemicals are completely metabolized (transformed into new compounds) by organisms and escape detection in tissue; however, the presence of tumours and other abnormalities may provide an early warning mechanism to identify exposure (see Appendix 7, Map 3).

Scientists and environmental managers view these data as indicators of change in the environment and consider them to be of sufficient significance to undertake political actions to restrict the use, transport and disposal of specific chemicals. These types of data also play a critical role in the setting of public health guidelines aimed at reducing the risk of toxicity to humans, for example the restrictions on the consumption of contaminated fish.



Technical Box 7.2.1

**Contaminants in Biota:
an Indicator of Environmental Response**

Since the 1960s there has been a growing awareness that the global ecosystem has become increasingly contaminated with persistent organochlorine chemicals such as DDT, 2,4-D, and PCBs, from agricultural, forestry and industrial sources. Many of these chemicals are difficult to monitor in air or water since they become very dilute after disposal. However, these substances accumulate in the bodies of fish and other wildlife and thus can be more easily detected. Compounds such as DDT, DDE, dieldrin, mirex and PCBs have been monitored for some time. Now coming to the attention of scientists is the presence of dioxins, furans, PAHs in the tissues of fish and birds.

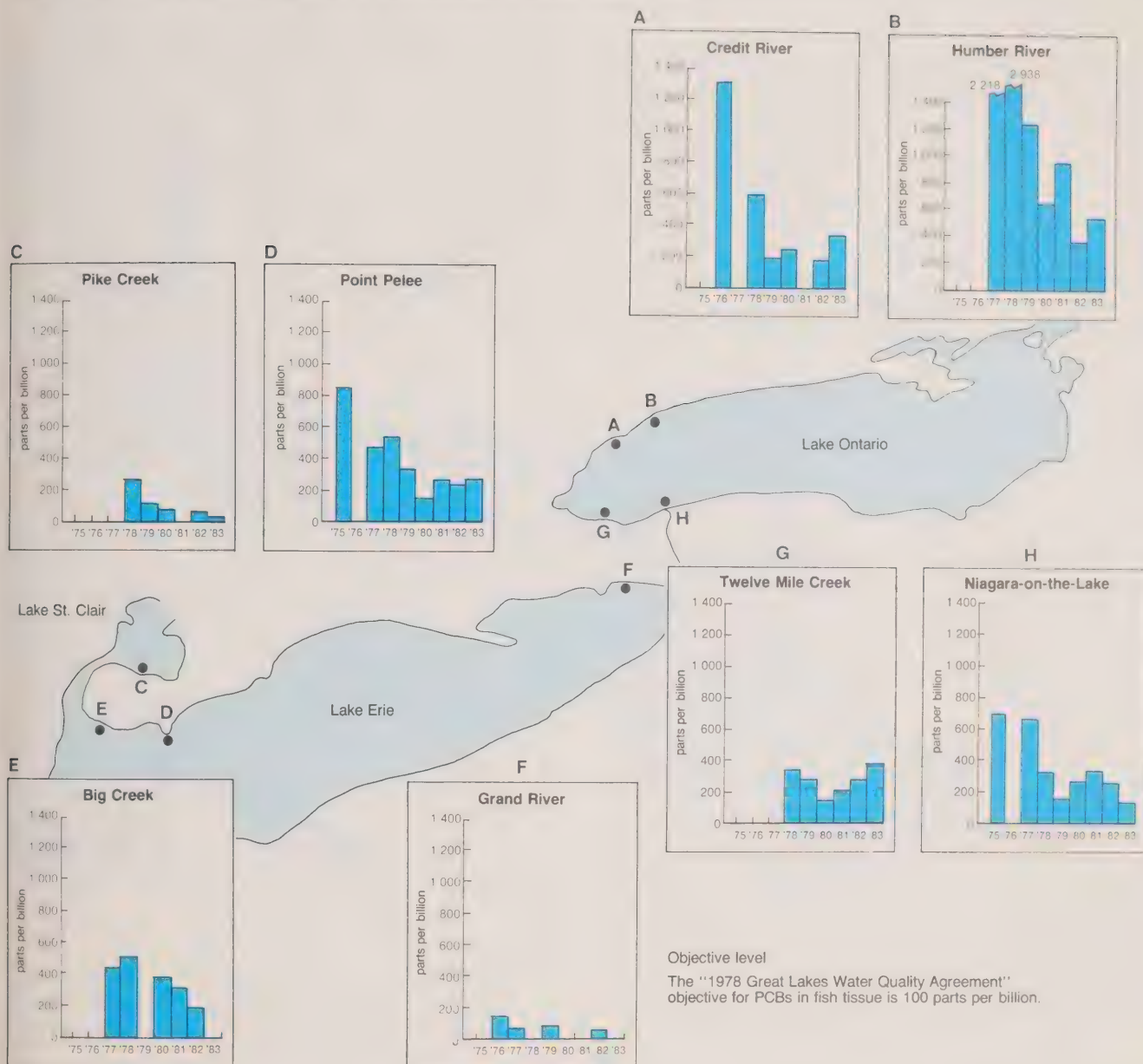
Three types of indicators of contaminants in aquatic systems are presented with example species. The first type, fish less than one year old with a limited swimming range, serve as locators of pollution sources (for example, spottail shiners). Second, eggs of bird species (for example, herring gulls) provide an instantaneous measure of contaminant levels since the concentration found in the eggs reflect what was eaten recently. The herring gull monitoring program has provided a long continuous record of contaminant trends in the Great Lakes basin. Third, top predators in the food chain are long-lived and forage in a large area. Their tissue burden represents the cumulative effect of contaminants in an ecosystem (for

example, trout and walleye, see Appendix 7, Map 2). Since whole fish samples are used, the levels of contaminants will be higher than in the edible (muscle) portion of the fish. These species serve as early warning indicators of possible threats to human health.

It should be noted that the significance of year to year changes in the level of contaminants may not always be understood by scientists; however absolute changes are more important than percentage ones. Long-term trend data permit the reader to evaluate the remedial actions established between government and industry. In Canada and the United States, a number of pesticides were restricted after 1969, and a ban on the use of PCBs in new non-electrical equipment began in 1977. Declining contaminant levels suggest that these policies are effective although disturbances in the sediments may retard the rate of decline for years to come.

Units:	Equivalent to:	Multiplying Factor:
parts per million (ppm)	milligrams per kilogram	10^{-6}
parts per billion (ppb)	micrograms per kilogram	10^{-9}
parts per trillion (ppt)	nanograms per kilogram	10^{-12}

Map 7.2.2

PCB¹ Residues² in Spottail Shiners from Selected Great Lakes Sites³

¹ PCBs (Polychlorinated Biphenyls) are a group of chemical compounds used in power transformers, electrical insulators, hydraulic fluids and many other products. PCBs have been found in the tissue of many animal species. There are concerns about the potential human health effect from exposure to these chemicals. Under the Environmental Contaminants Act, PCB use in new non-electrical equipment was banned in 1977. In 1980 the ban was extended to new electrical equipment.

² Composites of ten fish (constituting a single sample) were used for contaminant analyses of young-of-the-year fish. Since analyses of young fish show lower variations than analysis of older fish, small sample sizes can be used.

³ Data for the Upper Great Lakes were not included because the data base does not contain sufficient information for trend assessment.

Sources:

Ontario Ministry of the Environment, *Organochlorine Contaminant Declines and their Present Geographical Distribution in Great Lakes Spottail Shiners*, by K. Sun et al., 1981.

Ontario Ministry of the Environment, Water Resources Branch, unpublished data.

Note:

Young-of-the-year spottail shiners are indicators of current contaminant uptake conditions. Since they have a limited geographic range, they also serve as locators of sources of loadings of organochlorines.

Map 7.2.3

DDT¹ Residues in Spottail Shiners from Selected Great Lakes Sites

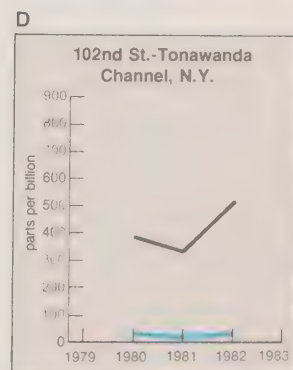
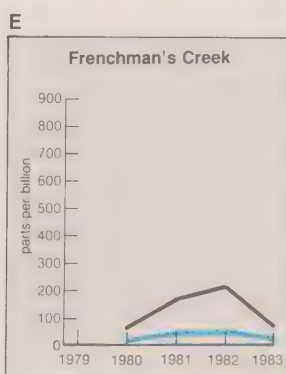
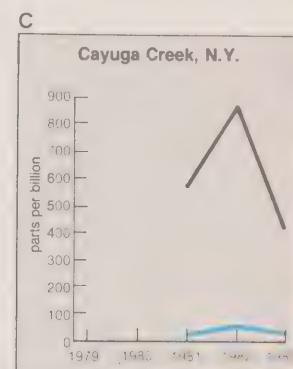
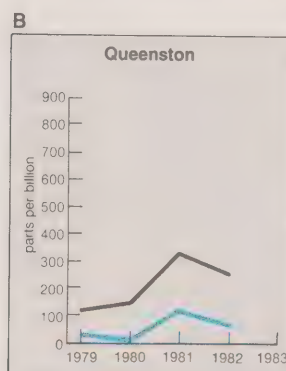
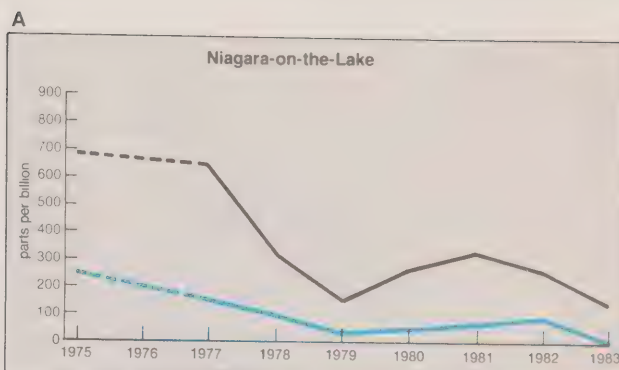
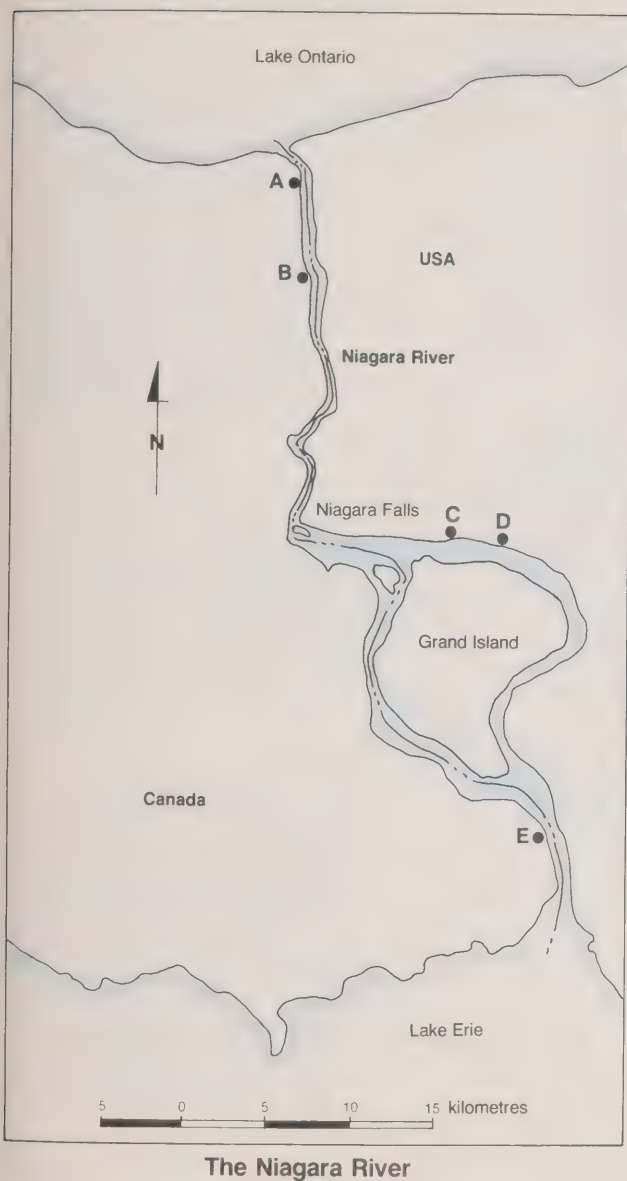
¹ Refers to the total weight of DDT pesticide and all of its metabolic forms found in animal tissue. This insecticide was once widely used for agricultural purposes. In 1969, its use was restricted when the effect of this chemical on the reproduction of many bird species became a major concern. At present, DDT is not manufactured in Canada and has limited registration and use.

Sources:

Ontario Ministry of the Environment, *Organochlorine Contaminant Declines and their Present Geographical Distribution in Great Lakes Spottail Shiners*, by K. Suns et al., 1981.

Ontario Ministry of the Environment, Water Resources Branch, unpublished data.

Chart 7.2.4
DDT¹ and PCB Residues in Spottail Shiners
from Selected Niagara River Sites



— PCBs
- - - DDT

¹ Refers to the total weight of DDT pesticide and all of its metabolic forms found in animal tissue.

Sources:
Ontario Ministry of the Environment, Water Resources Branch, unpublished data.

K. Suns *et al.*, "Organochlorine Contaminant Residues in Spottail Shiners (*Notropis Hudsonius*) from the Niagara River." *Journal of Great Lakes Research* Volume 9, Number 2, pages 335-340, 1983.

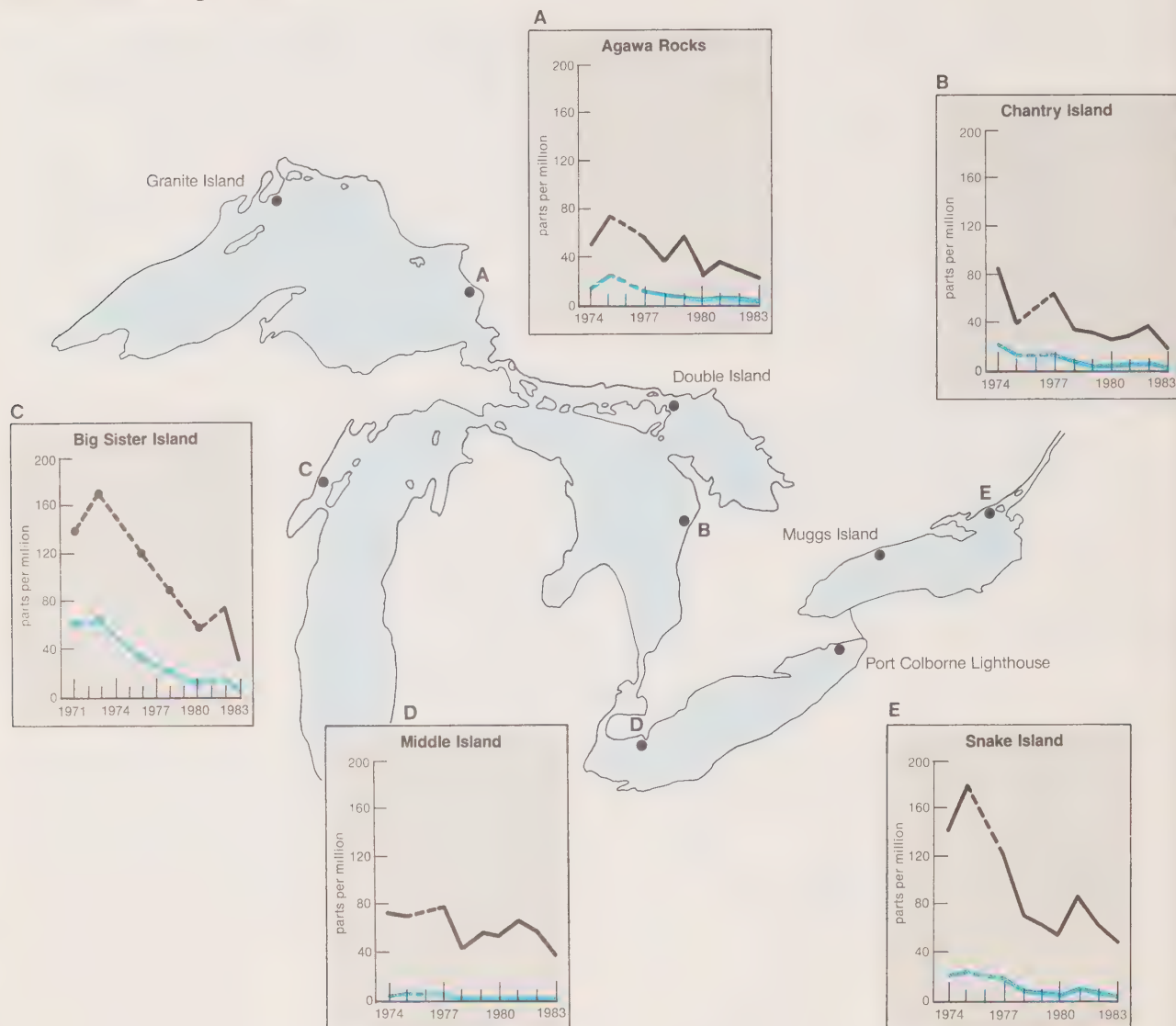
Note:
Elevated levels of industrial wastes have been found in the sediments, ambient water, ground water, and local fish of the Niagara River basin. These have now been linked to the seepage of chemicals from liquid waste disposal sites in the area.

Objective level

The "1978 Great Lakes Water Quality Agreement" objectives for PCBs in fish tissue is 100 parts per billion. For total DDT (DDT plus metabolites), it is 1000 parts per billion. (not shown on graphs)

Map 7.2.5

DDT and PCB Residues in Herring Gull Eggs¹ from Selected Great Lakes Nesting Colonies²



¹ Due to the nature of the metabolism of herring gulls, the concentration of contaminants in eggs reflects the concentration of these substances in the diet of the birds two to three weeks prior to egg laying. Since the time of exposure can be pinpointed in this manner, gulls provide an instantaneous measure of pollutants in the ecosystem.

² The map also indicates other colonies for which herring gull monitoring data are available from Environment Canada.

³ DDE, the main metabolized form of DDT, was measured. Virtually all DDT introduced to the environment is now in metabolized form.

Source:

Environment Canada, Canadian Wildlife Service, Burlington, Ontario.

Note:

The herring gull is a fish-eating bird that remains within the Great Lakes Basin during its adult life. Gull populations suffering from severe reproductive problems in the early 1970s now have normal reproductive rates. This improvement may be linked to regulations introduced to control the use of PCBs and pesticides.

— PCBs

- - - DDT³

Note:

Dotted lines refer to years when data were not collected.

Table 7.2.6
DDT and PCB Residues in Atlantic Seabird Eggs¹

Species	Year	Sampling Location ²			
		Bay of Fundy		Open Ocean	
		DDT ³	PCBs	DDT ³	PCBs
		parts per million		parts per million	
Leach's Petrel ⁴	1968	..	..	1.46	2.38
	1972	6.81	11.10	2.48	2.68
	1976	1.75	3.45	0.75	1.92
	1980	1.13	4.37	0.46	1.55
	1984	1.05	3.44	0.40	1.16
Atlantic Puffin ⁵	1968	..	..	0.89	2.33
	1972	2.57	7.20	0.76	1.67
	1976	1.27	6.10	0.59	1.86
	1980	1.03	5.53	0.55	2.50
	1984	0.74	3.23	0.30	0.99
Double-Crested Cormorant ⁶	1972	6.51	14.60	2.85	11.50
	1976	1.49	6.31	2.18	14.30
	1980	1.91	12.40	1.34	10.10
	1984	1.07	3.60	1.88	11.50

¹ Only species and locations where time-series were available are presented here. In all, twenty-six colonies and seven species have been sampled for six contaminants. Values shown are geometric means.

² Colonies have been grouped into Bay of Fundy or open ocean to compare levels of stress. The cormorant data listed in the open ocean column come from Ile-aux-Pommes in the Gulf of St. Lawrence.

³ DDE, the main metabolite of DDT, was measured.

⁴ Colonies of Leach's petrel are located at Kent Island in the Bay of Fundy and Great Island, Newfoundland. Petrels feed on micro-organisms at the water surface.

⁵ Colonies of Atlantic puffin are located at Machias Seal Island in the Bay of Fundy, and Great Island, Newfoundland. Puffins feed on fish.

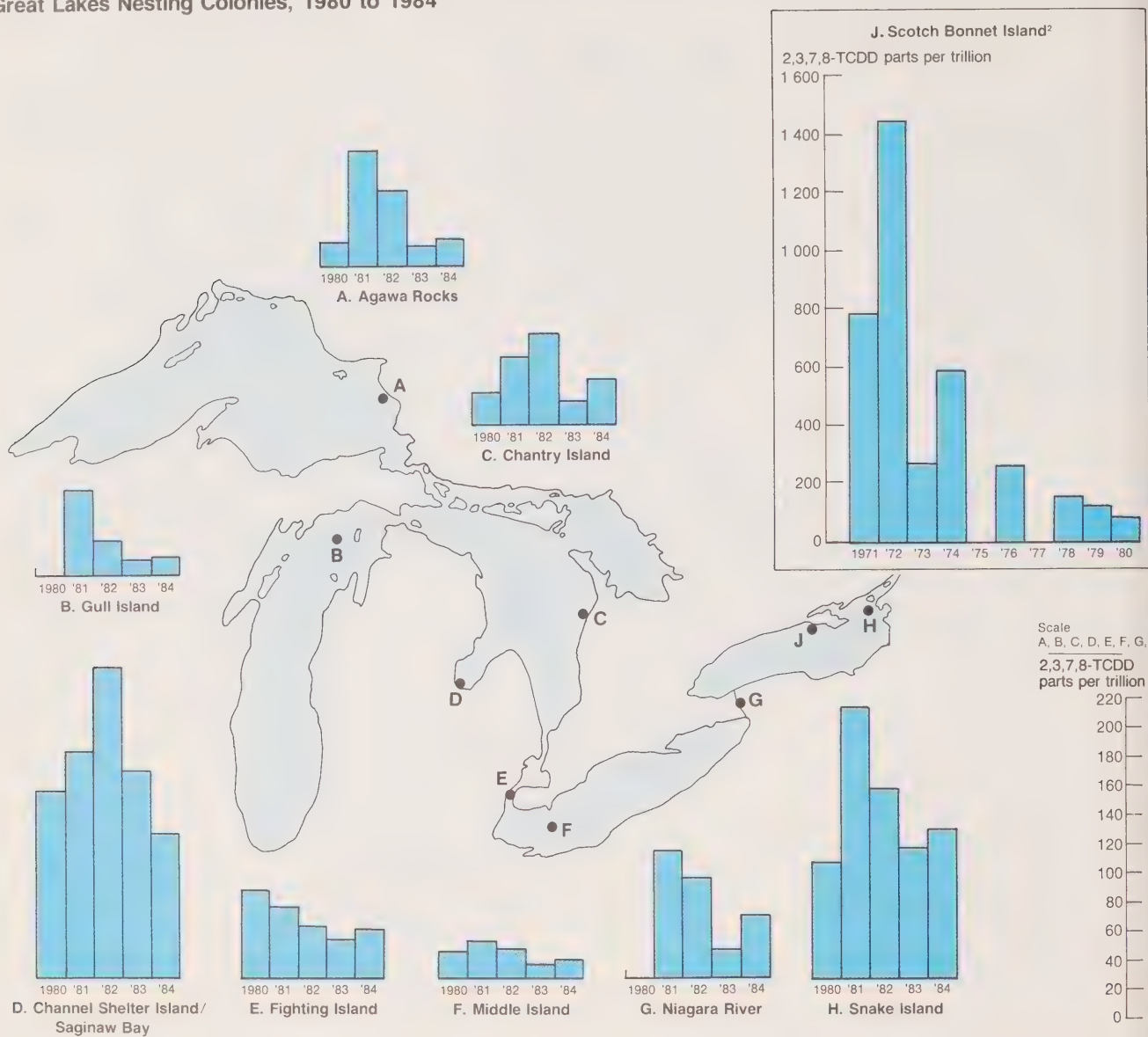
⁶ Colonies of double-crested cormorant are located at Manawagonish in the Bay of Fundy and Ile-aux-Pommes, Québec. Cormorants feed largely on fish.

Source:

Environment Canada, Canadian Wildlife Service, Wildlife Toxicology and Pathology Division, D.B. Peakall, unpublished data.

Map 7.2.7

Dioxin Concentrations¹ in Herring Gull Eggs from Selected Great Lakes Nesting Colonies, 1980 to 1984



¹ Dioxins are a group of 75 chemicals, of which the most toxic is 2,3,7,8-TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin). They are by-products formed during production of organic chemicals or during the combustion of organic materials. Chemicals containing dioxin impurities are wood preservatives (PCP), herbicides (2,4,5-T and 2,4-D), electrical insulator and hydraulic fluids (PCBs).

The methodology for detecting the 2,3,7,8-TCDD has been modified since original analyses were done. Data for 1980 and before have been corrected and are now consistent with data after 1981. The trend in dioxin concentration has followed that of other organochlorines in the Great Lakes.

² The availability of herring gull eggs from stored samples dating back to 1971 enabled scientists to obtain time trends of dioxin levels in eggs from the Scotch Bonnet Island colony, although this site is not part of the regular program.

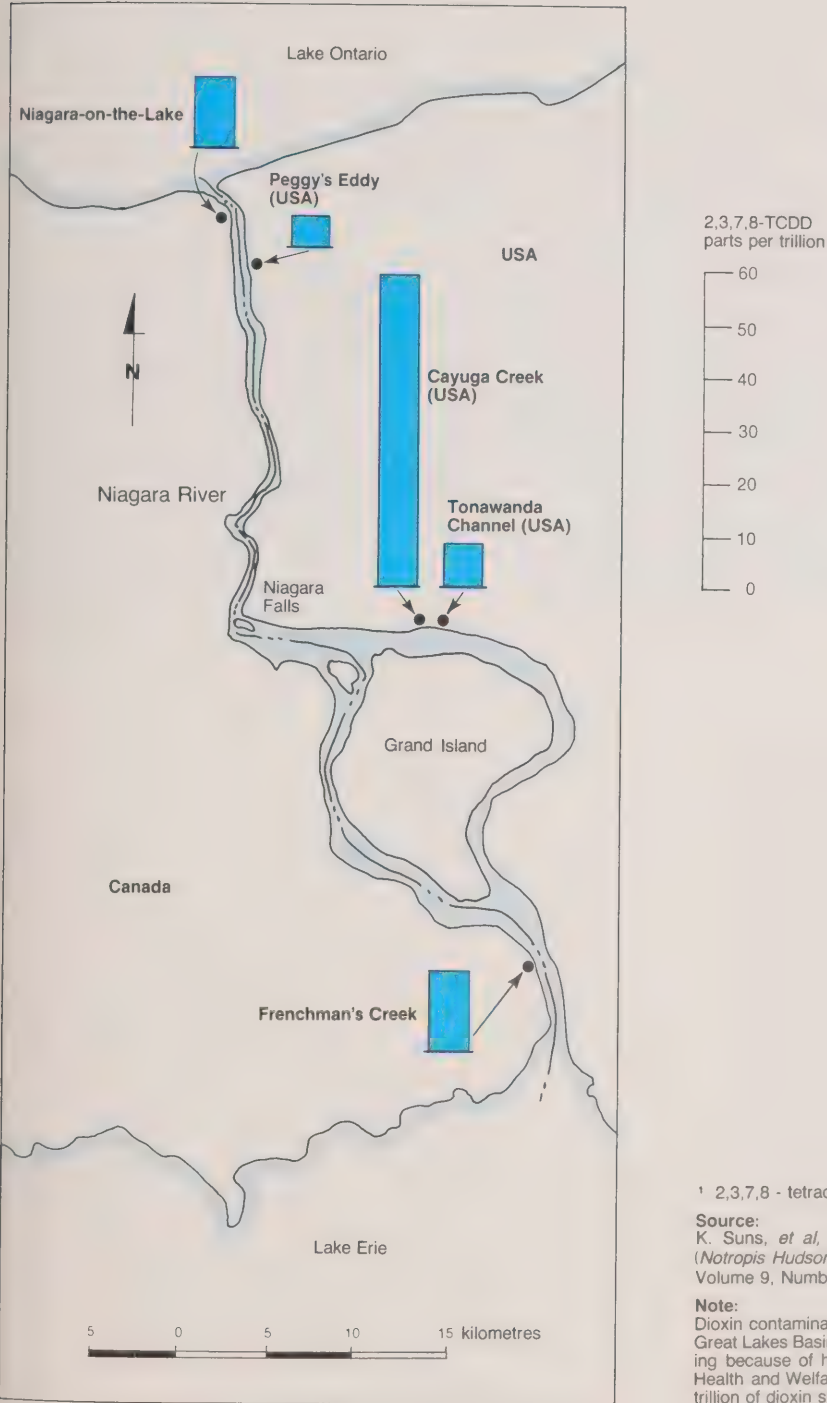
Source:

Environment Canada, Canadian Wildlife Service, R.J. Norstrom.

Note:

The discovery of high TCDD levels in herring gull eggs in 1980 led to bilateral action. Health and Welfare Canada and the New York State Department of Health issued warnings regarding the consumption of fish. Intense efforts have also been made to find and control sources of this chemical.

Map 7.2.8
Dioxin Residue¹ in Spottail Shiners from Selected Niagara River Sites, 1981



The Niagara River

¹ 2,3,7,8 - tetrachlorodibenzo-p-dioxin.

Source:
K. Suns, *et al*, "Organochlorine Contaminant Residues in Spottail Shiners (*Notropis Hudsonius*) from the Niagara River" *Journal of Great Lakes Research*, Volume 9, Number 2, pages 335-340, 1983.

Note:
Dioxin contamination has been found in sportfish at a number of locations in the Great Lakes Basin. Peggy's Eddy (map location 2) has been closed to sportfishing because of high levels of 2,3,7,8-TCDD. The Health Protection Branch of Health and Welfare Canada advises that fish containing more than 20 parts per trillion of dioxin should not be consumed on a regular basis.

Technical Box 7.2.9

**Mercury Contamination in Biota:
an Indicator of Environmental Response**

One of the early indicators of environmental contamination from heavy metals was the level of mercury in fish. Until regulations were introduced in the early 1970s, industrial effluents containing inorganic mercury entered the aquatic environment. These were associated with the use of mercury cells in chlor-alkali plants (chlorine production) and mercury in pulp mills (slimicides). Mercury is deposited in the sediments of lakes and streams and becomes bioavailable through the activity of bacteria (methylation). Although the major sources of mercury to lakes and streams have been restricted, disturbances to the sediments (through natural hydrological activity and through dredging of harbours and channels) make it necessary to continue the surveillance of mercury.

In 1969, high concentrations of mercury in fish were

found in the vicinity of chlor-alkali plants, pulp mills, and mines (associated with sulphide ore deposits). These levels were sufficiently high to impose a health risk to human consumption; as a result, a number of commercial fisheries (e.g. Lake St. Clair, Lake Winnipeg, English-Wabigoon) were closed and anglers warned.

In the tables that follow, top predators in the food chain are selected. These fish have bioconcentrated mercury in their tissues and can be used as indicators of changes in the mercury levels in aquatic ecosystems in which concerns have been noted. Specifically, walleye are more affected by mercury transported from upstream while pike and other bottom-dwelling fish are more affected by mercury in the sediments.

Cross reference: Chart 6.2.16

Chart 7.2.10
Mercury Concentration in Walleye in the English-Wabigoon River System, 1970 to 1981

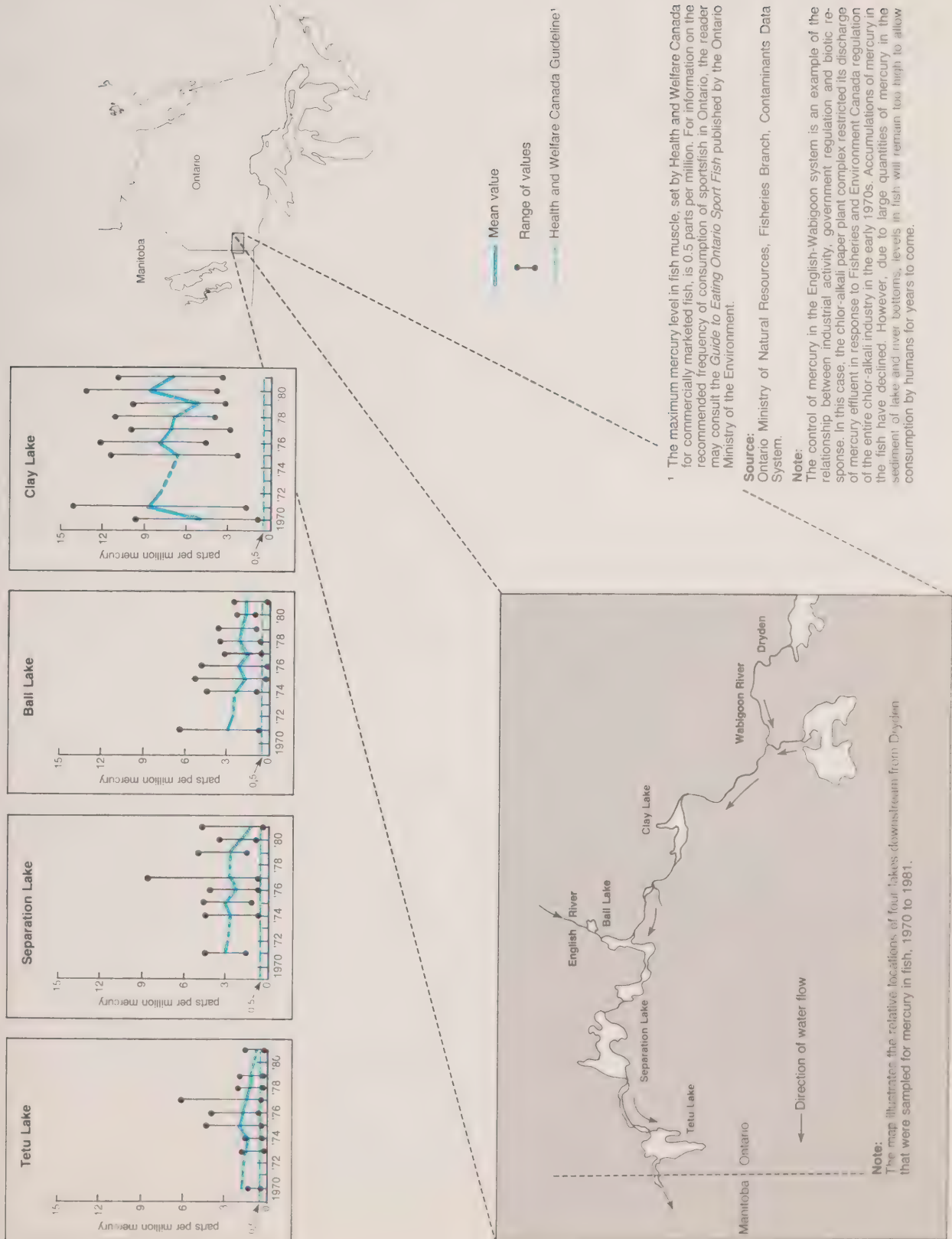


Table 7.2.11
Mercury Concentration in Walleye in Lake St. Clair and Lake Simcoe, 1970 to 1983¹

Year	Lake St. Clair ² (Whole Lake)			Percentage of Samples Containing Over 0.5 ppm Mercury	Lake St. Clair (Tremblay Creek)			Number of Observations	Lake Simcoe		
	Number of Observations	Mercury Concentration			Number of Observations	Mercury Concentration			Number of Observations	Mercury Concentration	
		Mean	Range			Mean	Range			Mean	Range
		parts per million				parts per million				parts per million	
1970	615	2.10	0.23-14.00	99	20	0.81	0.36-1.70	22	0.26	0.07-0.96	
1971	350	1.80	0.13-13.10	96	..	..	..	12	0.55	0.18-2.04
1972	436	1.30	0.13- 7.10	83	..	..	..	..	..	..
1973	291	1.10	0.13- 5.00	80	..	..	..	..	..	..
1974	590	0.98	0.10- 3.20	78	357	0.90	0.26-3.07	..	..	..
1975	69	0.81	0.16- 1.90	73	..	..	..	15	0.73	0.15-1.28
1976	246	0.93	0.11- 3.00	66	..	..	..	50	0.98	0.18-1.70
1977	..	..	..	..	35	0.81	0.37-1.60	27	0.60	0.10-1.60
1978	..	..	..	..	25	0.65	0.14-1.80	..	..	..
1979	..	..	..	..	30	0.81	0.11-1.51	36	0.53	0.11-1.45
1980	..	..	..	..	8	0.95	0.33-0.95	..	..	..
1983	..	..	..	..	..	..	..	15	0.55	0.13-1.90

¹ Although data were collected in most years, data presented here are only those where inter-calibration between laboratories had been achieved.

² Calculations of the mean of the whole of the lake were made from an Ontario Ministry of Environment Report that covered 1970 to 1976. Monitoring is now less extensive; however, Tremblay Creek has been taken as representative.

Source:

Ontario Ministry of Natural Resources, Contaminants Data System.

Note:

Discovery of mercury contamination resulted in the closure of the commercial fishery in Lake St. Clair from 1970 to 1980. It has now re-opened.

Table 7.2.12
Mercury Concentration in Walleye in Lakes of the Prairie Provinces, 1971 to 1983¹

Year	Cumberland Lake			Cedar Lake			Lake Winnipeg (North Basin)		
	Mercury Concentration		Percentage of Samples Containing Over 0.5 ppm ² Mercury	Mercury Concentration		Percentage of Samples Containing Over 0.5 ppm ² Mercury	Mercury Concentration		Percentage of Samples Containing Over 0.5 ppm ² Mercury
	Mean	Range		Mean	Range		Mean	Range	
	parts per million		percent	parts per million		percent	parts per million		percent
1971	..	..	..	0.53	0.11-1.83	40	0.44	0.09-1.24	22
1972	..	..	..	..	..	..	..	..	..
1973	..	..	..	0.48	0.10-1.32	30	0.41	0.10-1.21	16
1974	0.78	0.16-2.19	69	..	..	..	..	..	..
1975	0.67	0.23-1.68	59	0.48	0.23-0.71	17	0.27	0.14-1.00	6
1976	0.63	0.13-2.06	35	0.54	0.29-1.06	33	0.29	0.11-0.89	7
1977	0.68	0.20-1.63	64	..	..	..	..	..	..
1978	0.54	0.22-1.08	60	0.31	0.13-0.77	12	0.26	0.07-0.68	7
1979	0.81	0.14-2.93	58	..	..	..	..	..	..
1980	0.31	0.14-0.70	9	..	..	..	..	..	..
1981	0.71	0.20-1.26	60	..	..	..	..	..	..
1982	0.46	0.26-0.70	40	..	..	..	..	..	..
1983	0.34	0.19-0.72	20	..	..	..	..	..	..

¹ Based on samples taken from commercially landed fish.

² The maximum allowable mercury level in fish muscle, set by Health and Welfare Canada for commercially marketed fish, is 0.5 parts per million.

Source:

Fisheries and Oceans Canada, Freshwater Institute, Winnipeg, unpublished data.

Note:

Mercury contamination of these lakes (and subsequent bio-accumulation in walleye) is believed to have occurred as a result of discharge from chlo-alkali plants.

Table 7.2.13

Mercury Concentration in Walleye and Pike in Québec Drainage Basins, 1979

Drainage Basins ¹	Walleye ²				Pike ²			
	Number of Lakes	Number of Observations	Mercury Concentration		Number of Lakes	Number of Observations	Mercury Concentration	
			Mean	Range			Mean	Range
parts per million				parts per million				
Eastern Townships Rivers (144)	5	20	0.56	0.31-1.00	4	7	0.34	0.25-0.40
Ottawa River (150,151)	29	145	0.56	0.04-1.33	29	95	0.56	0.18-1.15
St. Lawrence River, St. Maurice River, Montreal Area Rivers (141,143,145)	15	70	0.54	0.17-1.14	13	35	0.54	0.12-1.35
Saguenay River (110.3,140)	4	19	0.23	0.21-0.24	3	13	0.94	
Gulf of St. Lawrence, North Coast								
Mainland (110.1,110.2)	..	..	..	..	6	27	0.66	0.27-2.41
South and West Hudson Bay (210.1,210.2,210.3)	2	3	0.52	..	4	5	0.52	0.26-0.98

¹ The basins shown here are groupings of our drainage basins. The basin codes indicate the constituent basins. Refer to Map 1.1.4 for their locations.

² Walleye and Pike are "top predators" in the aquatic ecosystem. By eating fish that contain mercury, they accumulate it in their own flesh.

Source:

Environnement Québec, Bureau d'étude sur les substances toxiques, *Contamination mercurielle du poisson gibier du Québec*, 1980.

Table 7.2.14

Mercury Concentration in Fish from the Fraser River¹, 1980

	White Sturgeon ²			Large-Scale Sucker ²			Northern Squawfish ²		
	Number of Observations	Mercury Concentration		Number of Observations	Mercury Concentration		Number of Observations	Mercury Concentration	
		Mean	Range		Mean	Range		Mean	Range
		parts per million			parts per million			parts per million	
Lower Fraser (Estuary to Chilliwack)	21	0.17	0.05-0.39	41	0.22	0.05-0.50	30	0.52	0.19-1.23
Upper Fraser (Chilliwack to Alberta Border)	10	0.17	0.05-0.37	40	0.23	0.05-0.26	25	0.23	0.11-0.49

¹ Pollution concerns include untreated wastes, discharge from upstream activity and the build-up of toxic wastes in the estuary. There are over 100 industrial outfalls to the Lower Fraser River; municipal sewage systems may contain industrial discharges as well.

² Since walleye are not found west of the Rocky Mountains, three other predators were chosen as indicators of mercury levels in aquatic ecosystems. Each has different exposures to mercury. Adult northern squawfish are primarily fish-eating (piscivorous), white sturgeon are anadromous (adult life at sea returning to spawn in coastal inland waters) and has a varied diet, while the adult large-scale sucker feeds on bottom dwelling invertebrates.

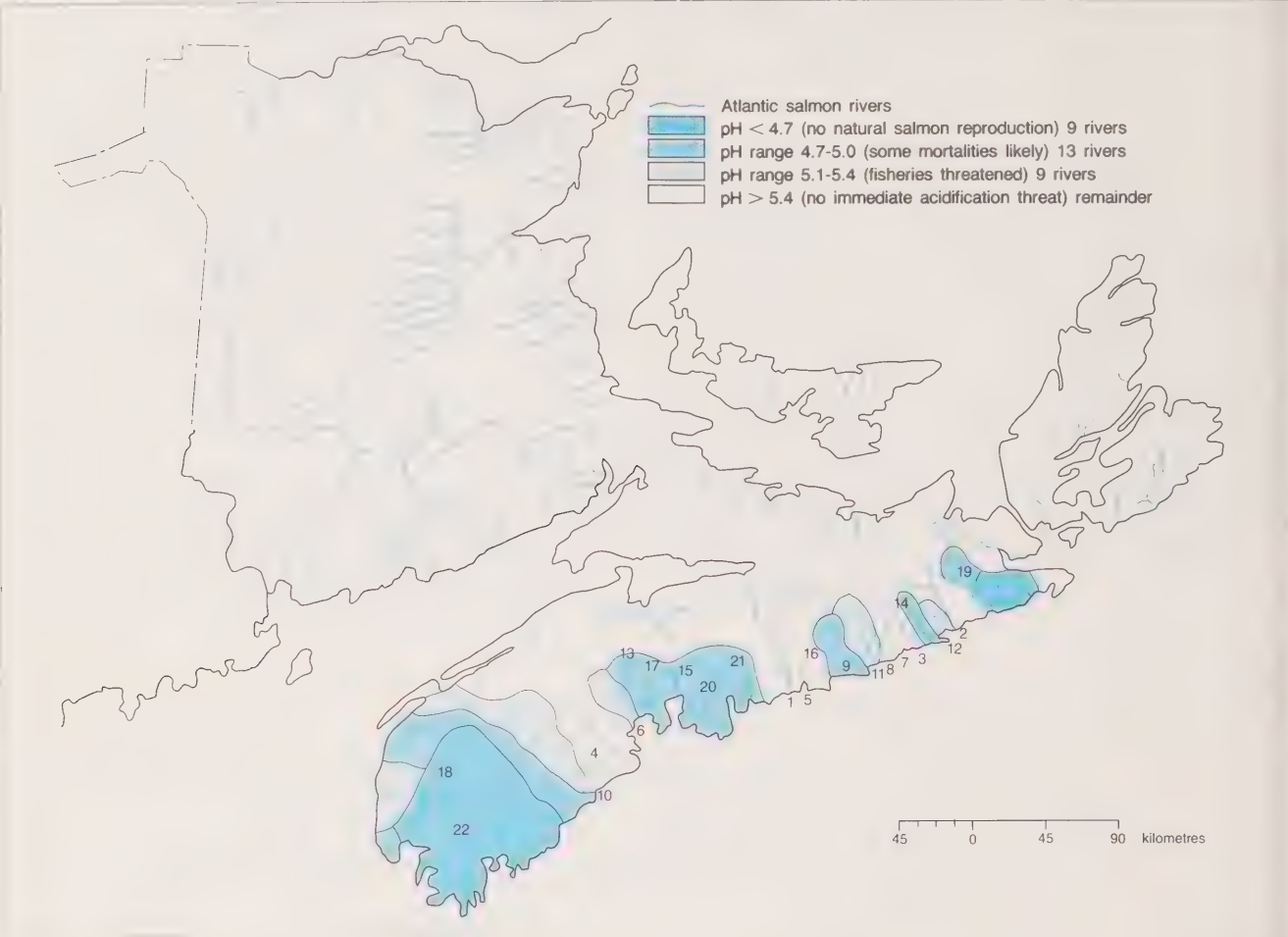
Source:

British Columbia Ministry of the Environment. *Trace Metals and Selected Organic Contaminants in Fraser River Fish*, 1983.

Note:

Eleven locations on the Fraser River were sampled in 1980. Although comparisons with samples from an earlier date (1972-73) show that the 1980 levels are consistently lower than in the earlier period, elevated levels at two sites in the lower Fraser may be cause for concern given the toxic effects of this metal.

Map 7.2.15
Acidity¹ of Atlantic Salmon Rivers in the Maritime Provinces



¹ pH is a logarithmic measure of the acidity of water. Values below 7.0 are increasingly acidic. *Cross reference:* see Map 6.6.26 for a more detailed explanation of pH and sensitive areas of Eastern Canada.

Source:
W.D. Watt, *Present and Potential Effects of Acid Precipitation on the Atlantic Salmon in Eastern Canada*. International Atlantic Salmon Foundation, Special Publication Series, No. 10, March 1981, St. Andrews, New Brunswick.

Note:
River systems where pH values are low enough to interfere with the reproduction of Atlantic salmon occur only in Nova Scotia. Salmon runs in 9 rivers with annual mean pH values below 4.7 are now considered extinct. Rivers within the pH 4.7 to 5.0 range still have self-sustaining runs but are subject to high mortality of juveniles related to water acidity. Those rivers in the range of pH 5.1 to 5.4 have thriving salmon runs, yet may be subject to the sub-lethal effects of acidity. The remaining rivers in the Maritimes are adequately buffered and are not under any immediate threat from acid rain.

Twenty-two Nova Scotia Salmon¹ Rivers Used to Compare the Effects of Acidification² 1979-1980

The list of rivers and the notes here refer to Chart 7.2.16. The rivers themselves can be located on Map 7.2.15 by number.

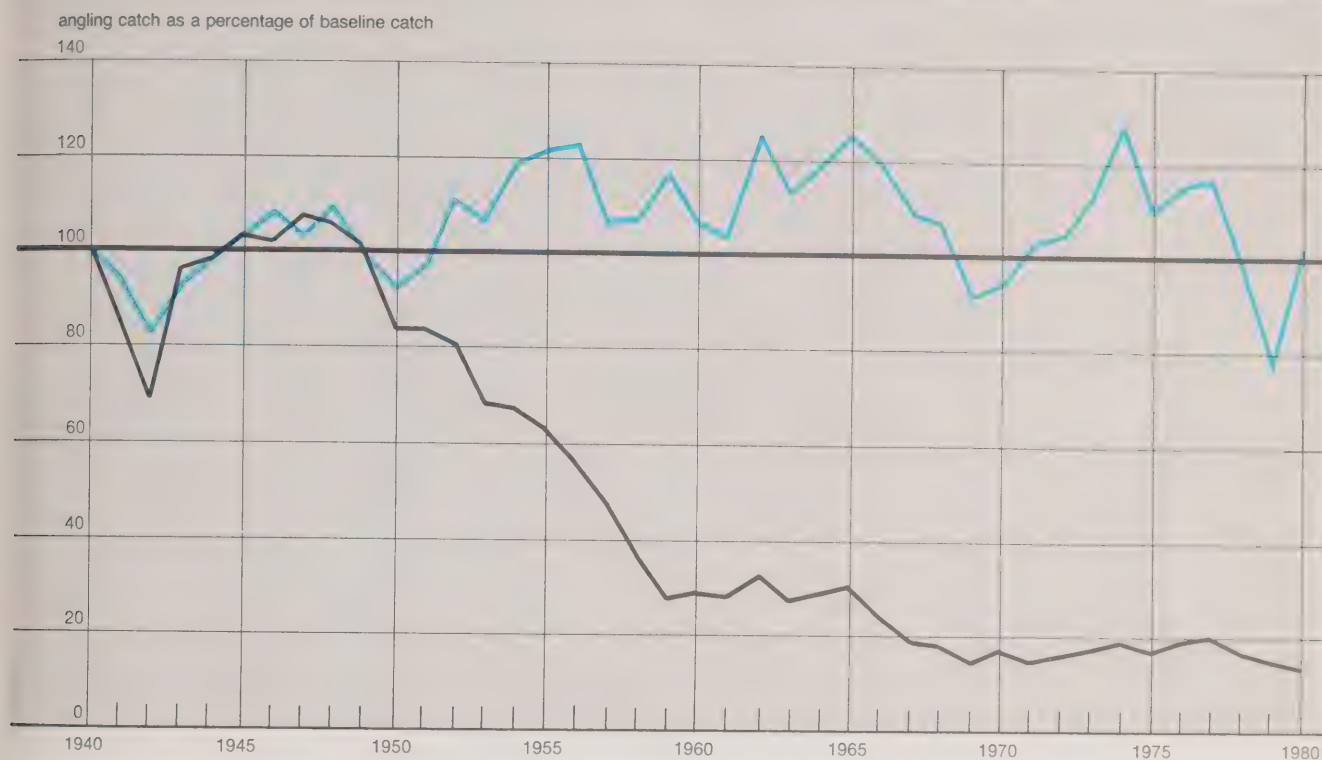
Rivers with pH > 5.0		Mean pH 1980-81	Rivers with pH ≤ 5.0		Mean pH 1980-81
1	Musquodoboit	6.7	13	Middle	5.0
2	St. Mary's	6.1	14	Liscomb	5.0
3	Ecum Secum	5.7	15	Ingram	5.0
4	Petit	5.6	16	Tangier	4.9
5	Ship Harbour	5.6	17	East	4.8
6	Gold	5.5	18	Tusket	4.8
7	Moser	5.4	19	Isaacs Harbour	4.8
8	Quoddy	5.4	20	Nine Mile	4.8
9	Kirby	5.4	21	Salmon (Lawrencetown)	4.7
10	Medway	5.4	22	Clyde	4.6
11	Salmon (Port Dufferin)	5.3			
12	Gaspereaux	5.2			

¹ See map for locations.
² In geologically sensitive areas, river pH levels have fallen significantly since 1954.

Note:
When comparing Map 7.2.15 and Chart 7.2.16 note that rivers with no natural salmon reproduction (shaded area) presently do have angling catch reported. However, once the last surviving year class of fish returns to spawn for its last time, the natural stocks of those rivers will be extinct.

Chart 7.2.16

Angling Catch¹ of Atlantic Salmon in Twenty-two Nova Scotia Rivers² by Levels of Acid Stress, 1940 to 1980



¹ Angling catch for each river was expressed as a percentage of a baseline catch from the mean of the years 1936-1940. The rivers were grouped according to their 1980-81 mean pH (above 5.0 or 5.0 and below) and the percentages were averaged. Since extreme year-to-year fluctuations occurred, (partly from angler preference shifting from river to river), five year running means of the annual values were calculated and then plotted.

² Rivers with substantial hatchery stocking or major restructuring (dam construction or removal) have been excluded.

Source:

D.C. Watt, *et al*, "Evidence of Acidification of Some Nova Scotia Rivers and Its Impact on Atlantic Salmon, *Salmo salar*." *Canadian Journal of Fisheries and Aquatic Sciences*, Volume 40, pages 462-473, 1983.

— Rivers with pH > 5.0 in 1980
 — Rivers with pH ≤ 5.0 in 1980

Collective and Individual Human Responses



Contents

Tables

8.1.1	Selected Government Expenditures on the Environment, 1970 to 1980	331
8.1.2	Accelerated Capital Cost Allowances for Pollution Control Equipment by Industry	331
8.1.4	National Park Profiles	333
8.1.5	Provincial Parks by Ecozone	335
8.1.6	Park Area by Ecozone	336
8.1.7	Public Perception of the Most Important Environmental Problems at National and Provincial Levels, 1981	337
8.1.8	Public Perception of Pollution Change in Canada	337
8.1.9	Public Attitudes Concerning the Management of Forest Resources	338

Map

8.1.3	National and Provincial Parks	332
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Table 8.1.1
Selected Government Expenditures on the Environment, 1970 to 1980¹

Year	Water Purification and Supply	Sewage Collection and Treatment	Solid Waste Collection and Disposal	Pollution Control	Environmental Administration and Other	Total
millions of current dollars						
1970	210	229	99	7	12	557
1971	297	271	108	21	17	714
1972	417	325	118	43	88	992
1973	456	428	122	68	219	1 293
1974	628	490	170	77	249	1 614
1975	764	569	230	65	283	1 912
1976	880	763	245	90	280	2 259
1977	981	792	283	117	319	2 491
1978	1 190	711	316	139	334	2 690
1979	1 113	773	329	108	418	2 741
1980 ²	1 302	890	391	131	505	3 219

¹ All levels of government.

² Preliminary estimates. No more current estimates are available.

Source:

Statistics Canada, *Consolidated Government Finance*, Catalogue 68-202.

Note:

Water Purification and Supply — Covers outlays for the construction, operation and maintenance of water acquisition, treatment and distribution facilities. It also includes grants and subsidies in aid of research in this field.

Sewage Collection and Treatment — Provides for expenditures on the construction, operation and maintenance of sewage removal and treatment facilities including expenditures on sanitary sewers and combined sanitary-storm sewers (separate storm sewers are classified under "transportation and communications — roads"), booster stations, reclamation of sludge areas, and on inspection, cleaning and flushing of sewers. It also covers grants and subsidies in aid of research to cope with sewage problems.

Solid Waste Collection and Disposal — Includes outlays for these services as well as expenditures on incinerators, nuisance grounds or dumps for waste disposal purposes. Services contracted out are included.

Pollution Control — Provides for expenditure on the prevention of pollution and on reducing pollution's detrimental effects on the environment, but only where such expenditures cannot be allocated to a more specific sub-function, e.g., "solid waste collection and disposal". This category also covers outlays on general research and control activities; it includes grants and subsidies toward the development and use of anti-pollution devices and toward undertakings designed to restore or maintain a healthy environment.

Other — Covers miscellaneous expenditures which cannot be linked with any specific sub-function or which applies to several sub-functions; (e.g., the administrative expenditure of a department of the environment).

Table 8.1.2
Accelerated Capital Cost Allowances for Pollution Control Equipment by Industry

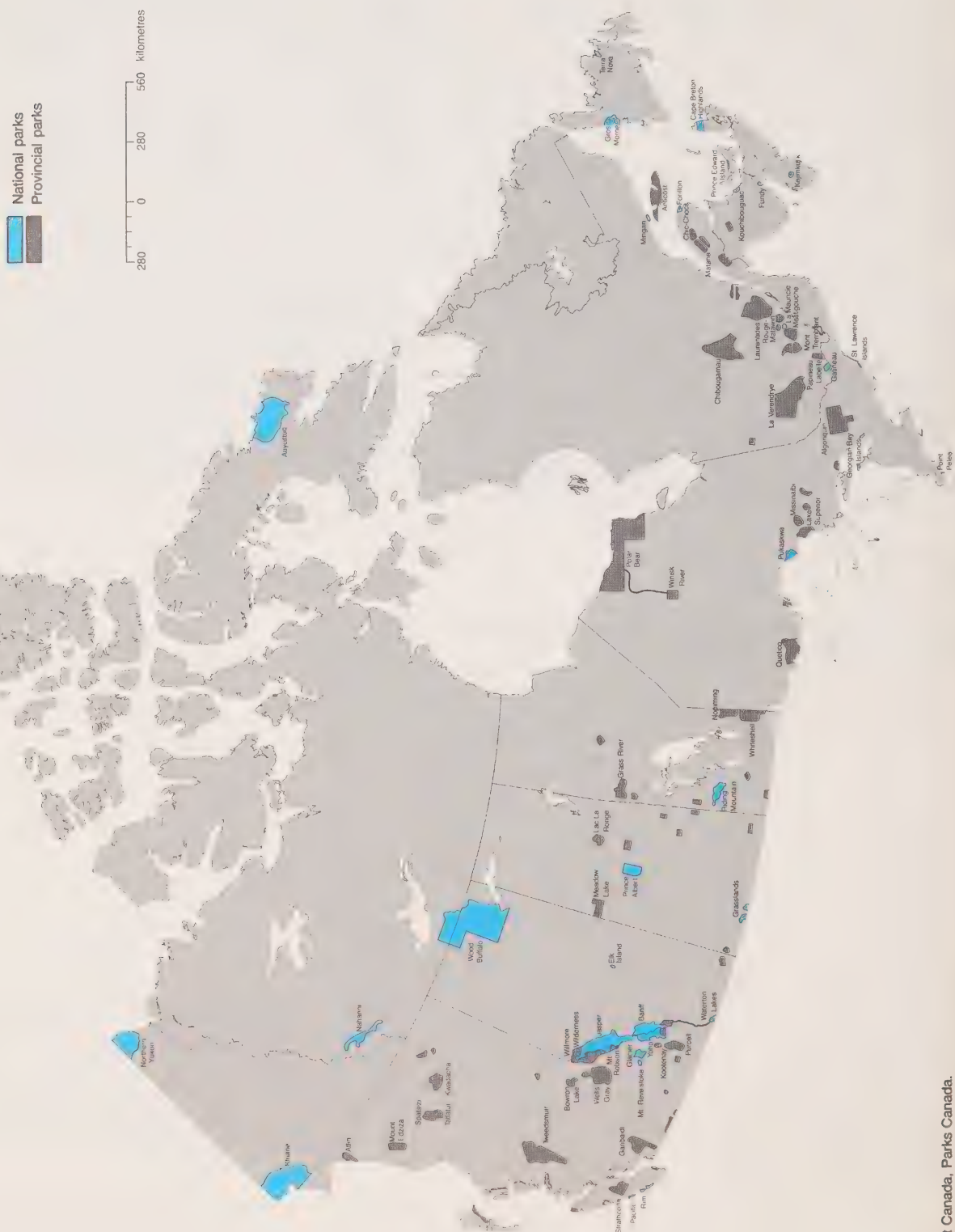
Industry	Allowance — Water 1969 to 1981		Allowance — Air 1971 to 1981	
	millions of dollars	percent	millions of dollars	percent
Mining	69.5	9.1	57.8	9.2
Manufacturing	647.7	84.5	419.9	66.7
Food and Beverages	32.6	4.3	24.7	3.9
Paper and Allied Industries	277.7	36.2	74.8	11.8
Primary Metals	136.8	17.8	152.1	24.2
Petroleum and Coal Products	62.6	8.2	43.9	7.0
Chemicals and Chemical Products	71.0	9.3	26.4	4.2
All Other Manufacturing	66.9	8.7	98.0	15.6
Transportation, Communication and Utilities	36.4	4.7	123.9	19.6
All Other Industries	13.3	1.7	28.0	4.5
Total	766.9	100.0	629.6	100.0

Source:

Statistics Canada, *Corporation Taxation Statistics*, Catalogue 61-208, various years.

Note:

Fifty percent of the capital costs of water pollution control assets acquired after April 26, 1965, may be deducted under the Income Tax Act. Air pollution control assets acquired after March 12, 1970 are also deductible at the same rate. The table above presents the aggregate of these allowances for the periods indicated. It should be noted, however, that the full allowance may not have been taken for a particular purchase as of 1981 as it is possible to spread the allowance across a number of years. These data provide an indication of total expenditures on pollution abatement equipment. Actual expenditure figures for the years 1970 to 1975 are available in an uncatalogued publication produced by Business Finance Division titled *Water and Air Pollution Abatement Expenditures*.

332
Map 8.1.3
National s

Note: Only provincial marks over 1 000 square kilometres are named; and only those over 100 square

Table 8.1.4
National Park Profiles

Ecozone/Park (Province)	Year Established	Area square kilometres	Visits 1983-1984	Biophysical and Cultural Features
Atlantic Maritime				
Prince Edward Island (PEI)	1937	32	1 606 920	Widely varied coastal environment, beaches, dunes, spits, Acadian forests, fresh and saltwater marshes; Green Gables and Dalvay House.
Cape Breton Highlands (NS)	1936	951	821 279	Igneous and metamorphic highlands, rugged coastlines, cliffs, beaches, and barrens.
Kejimikujik (NS)	1968	382	208 162	Coastal uplands, numerous lakes and rivers, peat deposits; historic Micmac Indian petroglyphs.
Forillon, (Qué)	1970	240	614 712	Coastal environment with rugged limestone cliffs; northern Appalachian mountain terrain with vegetation varying from mixed forests, to boreal to alpine-tundra; an abundance of bird life and a variety of sea mammals are present.
Kouchibouguac (NB)	1969	244	354 252	Acadian forested plains and coastal environments, barrier islands, lagoons, tidal rivers, salt-marshes, bogs, unique cedar groves.
Fundy (NB)	1948	207	865 901	Forested uplands, irregular coastline cut by deep valleys, varied flora and fauna including several species of large mammals.
Mixed-Wood Plain				
Point Pelee (Ont)	1918	16	483 679	Carolinian forest, marshes, beaches, staging ground for a variety of migratory bird species.
Georgian Bay Islands (Ont)	1929	24	124 216	Seventy-seven islands portray a transition between deciduous forest and the mixed forest of the southern shield; a heavily glaciated and flooded area with sheltered coves, sand and cobble beaches, drumlins and glacier-scraped rock; unusual geological formations on Flowerpot Island. Geology varies from Precambrian material to deposits similar to those of the Niagara escarpment; archeological evidence of a 1 000 year old Ojibway Indian settlement.
St. Lawrence Islands (Ont)	1904	8	219 389	Mainland area and a number of islands representing features of the Canadian Shield's Frontenac Axis; a variety of rare flora and fauna.
Boreal Shield				
Gros Morne (Nfld)	1970	1 943	245 097	Coastal and highland environments, fjords, lakes, variety of wildlife.
Terra Nova (Nfld)	1957	397	396 598	Coastal environments and boreal forest, rocky headlands, post-glacial features, bogs and inland ponds.
La Mauricie (Qué)	1970	544	252 008	Margin of the Canadian Shield; forest is transitional between mixed wood and boreal, many lakes, post-glacial relief.
Gatineau ¹ (Qué)	1937	356	975 000	Canadian Shield, forested hills, lakes, varied flora and fauna; Mackenzie King Estate.
Mingan Archipelago (Qué)	1984	85	...	Canadian Shield — Maritime margin; variety of bird species.
Pukaskwa (Ont)	1978	1 878	..	Representative of boreal uplands and the rugged coast of Lake Superior; turbulent rivers and streams, many lakes; a variety of boreal flora and fauna species; sixty kilometre coastal trail and white water canoe routes.
Prairie				
Grasslands (Sask)	1981	56	..	Remnants of natural prairies are preserved.
Elk Island (Alta)	1913	194	372 494	Forested plains, lakes; fenced preserve with large population of buffalo, deer, elk and moose.
Boreal Plain				
Prince Albert (Sask)	1927	3 875	282 171	Boreal forest, aspen groves and grasslands (park is in a transition area); glacial topography including eskers, drumlins, glacial lakes, spillways; pelican nesting colony, woodland caribou and bison.
Riding Mountain (Man)	1929	2 978	937 487	Post-glacial landforms and the blending of mixed-wood forests with grasslands and lakes; major features include the Manitoba escarpment and populations of large mammals.

Table 8.1.4
National Park Profiles (concluded)

Ecozone/Park (Province)	Year Established	Area square kilometres	Visits 1983-1984	Biophysical and Cultural Features
Montane Cordillera				
Jasper (Alta)	1907	10 878	1 896 263	Mountain ranges of limestones, quartzites, and argillites, glaciated valleys, Columbia Icefields; Maligne Valley contains underground river system; Large relatively undisturbed areas are critical for the maintenance of large mammal species such as grizzly bear, mountain goat, caribou, elk, sheep and wolves.
Banff (Alta)	1885	6 641	3 128 160	Mountain ranges composed of limestones and other deformed sediments, glaciated valleys, mineral hot springs, alpine meadows, glaciers, and other valley and mountain habitat supports quantity of wildlife including sizeable populations of large mammals; Banff townsite has 4,200 permanent residents.
Waterton Lakes (Alta)	1895	526	674 421	Mountain area with valley lakes; widely varied fauna and flora because the park is located near the boundary of the prairie and mountain ecosystems; archeological remains related to both the plains and mountains native cultures.
Kootenay (BC)	1920	1 406	2 289 968	Mountain ranges of limestone, quartzites and argillites, glaciated valleys, river canyons, geothermal features, significant populations of large mammals.
Glacier (BC)	1886	1 349	997 192	Extensively glaciated region of the Selkirk Mountains; variety of montane flora and fauna; Rodgers Pass is a major transportation corridor.
Yoho (BC)	1886	1 313	1 193 241	Mountain peaks of limestone, quartzites, argillites, glaciated valleys, mountain lakes, glaciers, Burgess Shales World Heritage Site, Canada's highest waterfall, a variety of montane flora and fauna including populations of large mammals.
Mount Revelstoke (BC)	1914	263	983 124	Heavily forested mountainous area, alpine meadows, glaciers.
Pacific Maritime				
Pacific Rim (BC)	1970	389	508 869	The park has three areas with distinct environments; Long Beach, the Broken Group Islands and the West Coast Trail; Rain forests are of particular significance; Park is especially noted for the abundance and diversity of marine mammals.
Boreal Cordillera				
Kluane (BC)	1972	22 015	50 213	St. Elias Mountains and glaciers are part of the world's largest non-polar icefields; Mount Logan, Canada's highest peak, rare bird and plant species, a variety of large mammal species including grizzly bear and Dall's sheep.
Tundra Cordillera				
North Yukon ² (YK)	1984	11 265	0	Variety of Arctic highland and coastal environments, important caribou range.
Nahanni (NWT)	1972	4 766	770	Mackenzie Mountains, canyons, Virginia Falls, Rabbit Kettle Hot Springs; world heritage site.
Taiga Plain				
Wood Buffalo ³ (Alta and NWT)	1922	44 807	1 404	Aspen-pine-spruce forests and open plains; largest herds of plains bison and wood bison in North America; unique salt flats with salt-tolerant plant species; gypsum karst formations; hunting and trapping by descendants of the original inhabitants.
Arctic Cordillera⁴				
Auyuittuq (NWT)	1972	21 471	459	A variety of Arctic environments, fjords, mountains, glaciers, Penny Ice Cap, arctic marine mammals; glacial and periglacial landforms, prehistoric archeological sites and contemporary Inuit culture.

¹ This park is located in the National Capital Region and is administered by the National Capital Commission rather than Parks Canada. The number of visits is for the calendar year 1983.

² A relatively small part of the North Yukon park extends into the Southern Arctic ecozone.

³ The largest part of Wood Buffalo Park lies in the Taiga Plain ecozone (30 738 square kilometres, 22 090 in Alberta and 8 648 in the Northwest Territories); A smaller part is located in the Boreal Plain ecozone of northern Alberta (14 069 square kilometres).

⁴ Parks Canada has recently announced the establishment of a new park on Ellesmere Island. Much of the park will be in this ecozone.

Source:
Environment Canada, Parks Canada, 1985.

Table 8.1.5
Provincial Parks by Ecozone¹

Ecozone/Park	Area in square kilometres	Ecozone/Park	Area in square kilometres	Ecozone/Park	Area in square kilometres
Atlantic Maritime					
Mount Carleton (NB)	174	Grundy Lake (Ont)	26	Long Lake (Alta)	8
Port Daniel (Qué)	64	Lady Evelyn River (Ont)	25	Calling Lake (Alta)	7
West Dover (NS)	9	Samuel de Champlain (Ont)	24	Moose Lake (Alta)	7
Blomidon (NS)	7	Chance Cove (Nfld)	21	Gregoire Lake (Alta)	7
Brudenell River (PEI)	6	Killbear (Ont)	18	Montane Cordillera	
Dollar Lake (NS)	6	Butter Pot (Nfld)	18	Tweedsmuir (BC)	9 811
North River (NS)	6	White Lake (Ont)	17	Wells Gray (BC)	5 273
Mactaquac (NB)	5	Squires Memorial (Nfld)	16	Willmore Wilderness (Alta)	4 597
Wollostook (NB)	5	Ivanhoe Lake (Ont)	16	Mount Robson (BC)	2 193
Mixed-Wood Plain		Petroglyphs (Ont)	16	Purcell (BC)	1 315
Fathom Five (Ont)	100	Lake Nipigon (Ont)	15	Bowron Lake (BC)	1 231
Mont-Orford (Qué)	58	La Manche Valley (Nfld)	14	E.C. Manning ² (BC)	714
Rondeau (Ont)	48	Kettle Lakes (Ont)	13	Kananaskis (Alta)	503
The Pinery (Ont)	25	Stag Lake (Nfld)	13	Vahalla (BC)	496
Paul-Sauvé (Qué)	19	Murphy's Point (Ont)	12	Mount Assiniboine (BC)	391
Awenda (Ont)	16	Lake of the Woods (Ont)	11	Cathedral (BC)	333
Wasaga Beach (Ont)	16	Arrowhead (Ont)	10	Kokanee Glacier (BC)	259
Carillon (Ont)	14	Freshwater Pond (Nfld)	9	Bugaboo Alpine (BC)	249
Yamaska (Qué)	13	Duley Lake (Nfld)	9	Hamber (BC)	245
Macgregor Point (Ont)	10	Jipujikuei Kuespen (Nfld)	9	Carp Lake (BC)	193
Tidewater (Ont)	10	Fitzgerald's Pond (Nfld)	8	Oakanagan Mountain (BC)	105
Mont-Saint-Bruno (Qué)	9	Marine Drive (Nfld)	8	St. Mary's Alpine (BC)	92
Presqu'île (Ont)	9	Silent Lake (Ont)	8	Top of the World (BC)	88
Charleston Lake (Ont)	9	Quimett Canyon (Ont)	8	Silver Star (BC)	87
Iles-de-Boucherville (Qué)	7	Restoule (Ont)	7	Nancy Greene (BC)	81
Sandbanks (Ont)	7	Backside Pond (Nfld)	6	Monashee (BC)	75
Cyprus Lake (Ont)	7	Jack's Pond (Nfld)	6	Elk Lake (BC)	56
Bronte Creek (Ont)	6	Pakwash (Ont)	6	Birkenhead Lake (BC)	36
Boreal Shield		Rainbow Falls (Ont)	6	Whiteswan Lake (BC)	20
La Vérendrye (Qué)	13 610	Prairie		Mount Terry Fox (BC)	19
Chibougamau (Qué)	11 025	Moose Mountain (Sask)	400	Darke Lake (BC)	15
Laurentides (Qué)	7 961	Spruce Woods (Man)	249	Champion Lakes (BC)	14
Algonquin (Ont)	7 653	Cypress Hills (Alta)	201	White Pelican (BC)	13
Anticosti (Qué)	6 747	Turtle Mountain (Man)	189	Stagleap (BC)	11
Quebec (Ont)	4 758	Cypress Hills (Sask)	182	Eneas Lakes (BC)	10
Whiteshell (Man)	2 734	Dinosaur (Alta)	60	Crooked River (BC)	10
Grass River (Man)	2 290	Saskatchewan		Haig Brown (BC)	10
Papineau-Labelle (Qué)	1 667	Landing (Sask)	56	Kalamaika Lake (BC)	9
Rouge-Matawin (Qué)	1 635	Douglas (Sask)	44	Dahl Lake (BC)	8
Mastigouche (Qué)	1 617	Bird Hill (Man)	35	Premier Lake (BC)	7
Lake Superior (Ont)	1 557	Danielson (Sask)	29	Beauvais Lake (Alta)	6
Lac La Ronge (Sask)	1 544	Assessippi (Man)	25	Apex Mountain (BC)	6
Nopiming (Man)	1 437	Goodspirit Lake (Sask)	20	Conkle Lake (BC)	6
Matane (Qué)	1 284	Buffalo Pound (Sask)	19	Fry Creek Canyon (BC)	6
Mont-Tremblant (Qué)	1 248	Waskwei River (Sask)	10	Pacific Maritime	
Chic-Chocs (Qué)	1 126	Dillberry Lake (Alta)	10	Strathcona (BC)	2 314
Gaspésie (Qué)	802	Dry Island Buffalo Jump (Alta)	10	Garibaldi (BC)	1 951
Rimouski (Qué)	797	Beaudry (Man)	9	Naikoon (BC)	726
St. Maurice (Qué)	782	Vermillion (Alta)	8	Golden Ears (BC)	556
Portneuf (Qué)	774	Anderson Island (Sask)	8	Skagit Valley (BC)	325
Jacques Cartier (Qué)	670	Matador Grasslands (Sask)	8	Cape Scott (BC)	151
Missinaibi Lake (Ont)	441	Echo Valley (Sask)	7	Desolation Sound (BC)	83
Saguenay (Qué)	350	Fish Creek (Alta)	7	Marine (BC)	82
Killarney (Ont)	341	Midland (Alta)	6	Schoen Lake (BC)	82
Grand-Jardins (Qué)	310	The Battlefords (Sask)	6	Mount Judge Howay (BC)	62
Sibley (Ont)	244	Pike Lake (Sask)	5	Mount Seymour (BC)	31
Aiguebelle (Qué)	238	Boreal Plain		Cypress (BC)	29
Paint Lake (Man)	226	Meadow Lake (Sask)	1 570	International Ridge (BC)	21
Mississagi River (Ont)	198	Hecla (Man)	863	Kitsumkalum Mountain (BC)	15
The Shoals (Ont)	112	Nipawin (Sask)	653	Sasquatch (BC)	12
Obatanga (Ont)	94	Clearwater Lake (Man)	596	Elk Falls (BC)	11
Wakami Lake (Ont)	88	Duck Mountain (Sask)	262	Kikomun Creek (BC)	7
Chapleau-Nemegosenda River (Ont)	82	Greenwater (Sask)	187	Liard River (BC)	7
Nagagamisis (Ont)	81	Wildcat Hill (Sask)	170	Hot Springs (BC)	7
Bon Echo (Ont)	66	Duck Mountain (Man)	127	Cultus Lake (BC)	7
Pistolet Bay (Nfld)	58	Nolikewin (Alta)	97	Boreal Cordillera	
Greenwater (Ont)	54	Gwillim Lake (BC)	92	Spatsizi (BC)	6 597
Fushimi Lake (Ont)	53	Lesser Slave Lake (Alta)	73	Atlin (BC)	2 711
Halfway Lake (Ont)	47	Crimson Lake (Alta)	34	Mount Edziza (BC)	2 327
Barachois Pond (Nfld)	35	William A. Switzer (Alta)	27	Kwadacha (BC)	
Neys (Ont)	34	Grand Beach (Man)	25	Wilderness (BC)	1 675
Mattawa River (Ont)	33	Hilliard's Bay (Alta)	23	Tatalatui (BC)	1 058
Esker Lakes (Ont)	32	Cross Lake (Alta)	21	Muncho Lake (BC)	884
Sandbar Lake (Ont)	32	Carson-Pegasus (Alta)	12	Stone Mountain (BC)	257
Remi Lake (Ont)	30	Winigami Lake (Alta)	12	Boya Lake (BC)	46
Mississagi (Ont)	29	Young's Point (Alta)	11	Hudson Bay Plain	
Ojibway (Ont)	26	Moonshine Lake (Alta)	9	Polar Bear (Ont)	24 087
		Bow Valley (Alta)	8	Winisk River (Ont)	1 740

¹ Only parks of five square kilometres and over are included in this table. The table includes wilderness areas and wildlife reserves in which human activities or land use is restricted by the province; a wide range of levels of protection are found in the parks and areas included above.

² A small part of this park is located in the Pacific Maritime Ecozone

Source:
Provincial Government Departments with responsibility for parks

Table 8.1.6
Park Area by Ecozone

Ecozone	National Parks	Provincial Parks ¹	Total Park Area	Park Area as a Percentage of Ecozone Area
square kilometres				
Atlantic Maritime	2 022	282	2 304	1.5
Prince Edward Island	18	6	24	0.4
Nova Scotia	1 333	28	1 361	2.5
New Brunswick	431	184	615	0.8
Québec	240	64	304	1.5
Mixed-Wood Plain	48	383	431	0.3
Québec	0	106	106	0.2
Ontario	48	277	325	0.4
Boreal Shield	5 203	77 427	82 630	4.6
Newfoundland	2 340	230	2 570	2.1
Québec	985	52 643	53 628	7.7
Ontario	1 878	16 323	18 201	3.0
Manitoba	0	6 687	6 687	2.7
Saskatchewan	0	1 544	1 544	1.5
Prairie	250	1 561	1 811	0.4
Manitoba	0	507	507	0.7
Saskatchewan	56	752	808	0.3
Alberta	194	302	496	0.3
Boreal Plain	14 069	4 901	18 970	2.1
Manitoba	0	1 611	1 611	1.2
Saskatchewan	0	2 842	2 842	1.1
Alberta	14 069	356	14 425	3.8
British Columbia	0	92	92	0.1
Montane Cordillera	22 376	28 593	50 969	11.0
Alberta	18 045	5 106	23 151	52.8
British Columbia	4 331	23 487	27 818	6.6
Pacific Maritime	389	6 390	6 779	3.4
British Columbia	389	6 390	6 779	3.4
Boreal Cordillera	22 015	15 555	37 570	8.8
British Columbia	0	15 555	15 555	7.5
Yukon	22 015	0	22 015	10.1
Tundra Cordillera	16 031	..²	16 031	4.3
Yukon	11 265	.. ²	11 265	4.9
Northwest Territories	4 766	.. ²	4 766	3.2
Taiga Plain	30 738	...²	30 738	5.5
Alberta	22 090	0	22 090	32.4
Northwest Territories	8 648	... ²	8 648	1.9
Hudson Bay Plain	0	25 827	25 827	7.0
Ontario	0	25 827	25 827	9.3
Arctic Cordillera	21 471	...²	21 471	7.1
Northwest Territories	21 471	... ²	21 471	7.1

¹ Only parks of five square kilometres and over are included in the provincial parks column. The numerous smaller parks were not assigned to an ecozone.

² Territorial parks have been excluded.

Source:

Environment Canada, Parks Canada, 1984.

Statistics Canada, special tabulations by the Office of the Senior Adviser on Integration from provincial source material.

Table 8.1.7

Public Perception of the Most Important Environmental Problems at National and Provincial Levels, 1981¹

The Question:

"What do you consider to be the most serious environmental problem today?"

	Canada	Atlantic Canada	Québec	Ontario	Western Canada
"In Canada"	percent				
Water Pollution	22	13	26	23	22
Acid Rain	18	24	14	18	18
Air Pollution	9	9	10	12	5
Industrial Pollution	8	6	9	6	12
Pollution (unspecified)	7	7	8	8	4
Air and Water Pollution	6	7	5	5	6
Dump Sites/Chemical Dumps	3	3	1	4	3
Destruction of Forests	2	4	4	1	2
Destruction of Animals	1	0	2	1	1
Urbanization/No Green Spaces	1	1	1	1	1
Land/Soil Pollution	1	1	2	1	2
Don't Know and Other	22	25	18	20	24
Total	100	100	100	100	100
"In Your Province"	percent				
Water Pollution	27	11	43	21	26
Acid Rain	15	12	10	27	6
Air Pollution	8	6	6	11	8
Industrial Pollution	9	5	8	9	10
Pollution (unspecified)	6	6	8	7	4
Air and Water Pollution	6	3	5	5	7
Dump Sites/Chemical Dump	4	2	2	5	4
Destruction of Forests	6	36	2	1	5
Destruction of Animals	2	2	2	1	2
Urbanization/No Green Space	1	0	1	1	3
Land/Soil Pollution	1	1	1	1	2
Don't Know and Other	15	16	12	11	23
Total	100	100	100	100	100

¹ The total sample size was 1,960.

Source:

Centre de recherches sur l'opinion publique. (CROP) survey, June, 1981

Table 8.1.8

Public Perception of Pollution Change in Canada¹

The Question:

"Would you say that the level of pollution has increased, decreased or remained the same over the past two years?"

	Canada	Atlantic Canada	Québec	Ontario	Western Canada
"In Your Neighbourhood?"	percent				
Increased	38	40	40	36	38
Decreased	7	6	9	8	4
Same	52	51	48	52	55
Don't know	3	3	3	4	3
Total	100	100	100	100	100

"In Your Province?"

	percent				
Increased	65	71	64	61	67
Decreased	8	4	12	10	3
Same	20	22	18	19	24
Don't know	7	3	6	10	6
Total	100	100	100	100	100

The Question:

"Would you say that the level of pollution has increased, decreased or remained the same over the past two years?"

	Canada	Atlantic Canada	Québec	Ontario	Western Canada
"In Canada?"	percent				
Increased	70	86	66	61	76
Decreased	6	5	7	10	3
Same	15	6	19	16	15
Don't know	9	3	8	13	6
Total	100	100	100	100	100

¹ The sample size was 1,994. The question asked was asked in 1982 and thus refers to the period 1981-1982

Source:

Centre de recherches sur l'opinion publique (CROP) survey, 1982

Table 8.1.9

Public Attitudes Concerning the Management of Forest Resources¹

The Question:

"For each of the following statements about forest management please tell me whether you agree strongly, agree somewhat, disagree somewhat or disagree strongly based on your general impressions."

	Canada	Atlantic Canada	Québec	Ontario	Western Canada
percent					
"Companies should be free to harvest our forests without government regulation"					
Agree strongly	4	9	1	3	3
Agree somewhat	5	8	4	6	4
Disagree somewhat	17	15	21	16	14
Disagree strongly	73	68	72	73	78
Don't know	1	0	2	2	1
Total	100	100	100	100	100
percent					
"Chemicals, such as pesticides, are necessary for taking care of forests"					
Agree strongly	12	13	13	11	12
Agree somewhat	46	36	52	42	47
Disagree somewhat	24	28	24	23	23
Disagree strongly	15	21	8	19	15
Don't know	3	2	3	4	3
Total	100	100	100	100	100
percent					
"In recent years, more trees were cut down compared to the number of trees planted"					
Agree strongly	35	55	37	35	27
Agree somewhat	31	28	34	31	30
Disagree somewhat	16	12	14	14	21
Disagree strongly	6	2	4	9	6
Don't know	12	3	11	11	16
Total	100	100	100	100	100
percent					
"The forests should not be exploited economically at all"					
Agree strongly	18	25	8	25	17
Agree somewhat	20	20	14	23	20
Disagree somewhat	39	37	53	30	37
Disagree strongly	20	17	22	19	23
Don't know	3	1	3	3	3
Total	100	100	100	100	100

¹ The sample size was 1,960.² Information in Chapter 3.2 indicates that 22 percent of the cut was replanted or reseeded in the period 1976 to 1980.**Source:**

Centre de recherches sur l'opinion publique (CROP) Survey, June 1981.

Appendices

Appendix 1, Table 1	Drainage Basin Reference Codes	340
Technical Box 2	Special Tabulations of Data for Ecozones and Drainage Basins	342
Appendix 2, Table 1	Population and Population Density by Drainage Basin, 1971, 1976 and 1981	343
Appendix 3, Table 1	Monoculture Farms by Drainage Basin, 1971, 1976 and 1981	346
Appendix 4, Table 1	Estimated Efficiency Rating of Energy Forms by Use	348
Appendix 5, Table 1	Large Dams by Drainage Basin, 1982	349
Appendix 6, Table 1	Mining Activity by Ecozone, 1971, 1976 and 1981	352
Table 2	Mining Activity by Drainage Basin, 1981	353
Table 3	Manufacturing Activity by Ecozone, 1973, 1976 and 1981	356
Table 4	Manufacturing Activity by Stressor Type: Stress to Water, by Drainage Basin, 1981	357
Table 5	Manufacturing Water Use by Industry Group, 1976	360
Table 6	Population Served by Municipal Wastewater Treatment System by Drainage Basin	361
Table 7	Estimated Daily Waste Discharged from Municipalities by Drainage Basin	363
Appendix 7, Table 1	Flora and Fauna Species with Designated Status, 1985	364
Map 2	Mean PCB Concentrations in Whole Fish Samples of Trout and Walleye in the Great Lakes, 1972 to 1983	368
Map 3	Evidence of Lip Tumours on White Suckers from Lakes Huron and Ontario, 1981-1983	369
Appendix 8, Table 1	Federal and Provincial Environmental Legislation	370

Appendix 1, Table 1
Drainage Basin Reference Codes

	Province		Province
1. ATLANTIC OCEAN BASIN			
Atlantic Ocean Coastal Drainage			
100.1 - 10	Labrador Coast Rivers	Newfoundland	
100.2 - 10	Churchill and Naskaupi Rivers	Newfoundland	
101 - 10	Newfoundland, North Coast Rivers	Newfoundland	
102 - 10	Trinity Bay Coast Rivers	Newfoundland	
103 - 10	St. John's area Rivers	Newfoundland	
104 - 12	Nova Scotia, Southeast Coast Rivers	Nova Scotia	
Gulf of St. Lawrence Coastal Drainage			
110.1	Gulf, Mainland North Coast Rivers:		
110.1 - 10	Labrador part	Newfoundland	
110.1 - 24	Québec part	Québec	
110.2 - 24	Manicouagan and Outardes Rivers	Québec	
110.3 - 24	Betsiamites River	Québec	
111 - 10	Gulf, Newfoundland West and South Coast Rivers	Newfoundland	
112 - 24	North Gaspé Peninsula Rivers	Québec	
113	Gulf, Mainland South and West Coast Rivers:		
113 - 12	Nova Scotia part	Nova Scotia	
113 - 13	New Brunswick part	New Brunswick	
113 - 24	Québec part	Québec	
114 - 11	Prince Edward Island Rivers	Prince Edward Island	
115 - 12	Cape Breton Island Rivers	Nova Scotia	
Bay of Fundy Coastal - Saint John River Drainage			
120	Bay of Fundy Coast Rivers:		
120 - 12	Nova Scotia part	Nova Scotia	
121 - 13	New Brunswick part	New Brunswick	
130	Saint John River:		
130 - 13	New Brunswick part	New Brunswick	
130 - 24	Québec part	Québec	
St. Lawrence River Drainage			
140 - 24	Saguenay River	Québec	
141 - 24	Québec City area - Middle North Shore Rivers	Québec	
142 - 24	Chaudière River - Middle South Shore Rivers	Québec	
143 - 24	St. Maurice River	Québec	
144 - 24	Eastern Township Rivers - Richelieu River	Québec	
145 - 24	Eastern Laurentian Rivers	Québec	
146 - 24	Montréal area Rivers	Québec	
147	West St. Lawrence River:		
147 - 24	Québec part	Québec	
147 - 35	Ontario part	Ontario	
Ottawa River Drainage			
150	Lower Ottawa River:		
150 - 24	Québec part	Québec	
150 - 35	Ontario part	Ontario	
151	Upper Ottawa River:		
151 - 24	Québec part	Québec	
151 - 35	Ontario part	Ontario	
Lake Ontario Shore Drainage			
160 - 35	Belleville - Napanee area Rivers	Ontario	
161 - 35	Trent River	Ontario	
162 - 35	Oshawa - Colborne area Rivers	Ontario	
163 - 35	Toronto area Rivers	Ontario	
164 - 35	Hamilton area Rivers	Ontario	
165 - 35	Niagara Peninsula Rivers	Ontario	
Lake Erie and Lake St. Clair Shore Drainage			
170 - 35	Grand River	Ontario	
171 - 35	Lake Erie Shore Rivers	Ontario	
172 - 35	Thames River	Ontario	
173 - 35	Sydenham River	Ontario	
Lake Huron Shore Drainage			
180 - 35	South Huron Shore Rivers	Ontario	
181 - 35	Georgian Bay Shore - Lake Simcoe Shore Rivers	Ontario	
182 - 35	North Huron Shore Rivers	Ontario	
Lake Superior Shore Drainage			
190 - 35	Lake Superior Shore Rivers	Ontario	
2. HUDSON BAY AND UNGAVA BAY BASIN			
Hudson Bay and Ungava Bay Coastal Drainage			
200.1 - 24	East Hudson Bay Coast Rivers	Québec	
200.2 - 24	Ungava Bay Coast Rivers	Québec	
200.3 - 24	Eastmain and LaGrande Rivers	Québec	
210.1 - 24	Rupert and Nottaway Rivers	Québec	
210.2	Harricanaw River:		
210.2 - 24	Québec part	Québec	
210.2 - 35	Ontario part	Ontario	
210.3	Moose River:		
210.3 - 24	Québec part	Québec	
210.3 - 35	Ontario part	Ontario	
210.4 - 35	Albany River	Ontario	
210.5	Southwest Hudson Bay Coast Rivers:		
210.5 - 35	Ontario part	Ontario	
210.5 - 46	Manitoba part	Manitoba	
210.6	Hayes River:		
210.6 - 35	Ontario part	Ontario	
210.6 - 46	Manitoba part	Manitoba	
211.1	West Hudson Bay Coast Rivers:		
211.1 - 46	Manitoba part	Manitoba	
211.1 - 47	Saskatchewan part	Saskatchewan	
211.1 - 61	Northwest Territories part	Northwest Territories	
211.2	Thelon - Kazan Rivers:		
211.2 - 46	Manitoba part	Manitoba	
211.2 - 47	Saskatchewan part	Saskatchewan	
211.2 - 61	Northwest Territories part	Northwest Territories	
211.3	Churchill River:		
211.3 - 46	Manitoba part	Manitoba	
211.3 - 47	Saskatchewan part	Saskatchewan	
211.3 - 48	Alberta part	Alberta	
Nelson River Drainage			
220 - 46	Nelson River		
Lake Winnipeg Shore Drainage			
230	Lake Winnipeg Shore Rivers:		
230 - 35	Ontario part	Ontario	
230 - 46	Manitoba part	Manitoba	
231 - 46	Red River	Manitoba	
232	Dauphin River:		
232 - 46	Manitoba part	Manitoba	
232 - 47	Saskatchewan part	Saskatchewan	
Assiniboine River Drainage			
240	Assiniboine and Souris Rivers:		
240 - 46	Manitoba part	Manitoba	
240 - 47	Saskatchewan part	Saskatchewan	
241	Qu'Appelle River - Old Wives Lake:		
241 - 46	Manitoba part	Manitoba	
241 - 47	Saskatchewan part	Saskatchewan	
Saskatchewan River Drainage			
250	Saskatchewan River:		
250 - 46	Manitoba part	Manitoba	
250 - 47	Saskatchewan part	Saskatchewan	
251 - 48	Upper North Saskatchewan River	Alberta	
252	Lower North Saskatchewan River:		
252 - 47	Saskatchewan part	Saskatchewan	
252 - 48	Alberta part	Alberta	
253	South Saskatchewan River and Red Deer River:		
253 - 47	Saskatchewan part	Saskatchewan	
253 - 48	Alberta part	Alberta	
254 - 48	Bow River	Alberta	
3. ARCTIC OCEAN BASIN			
Mackenzie River Drainage			
300.1	Mackenzie River:		
300.1 - 60	Yukon part	Yukon	
300.1 - 61	Northwest Territories part	Northwest Territories	
300.2	Great Slave Lake Shore Rivers:		
300.2 - 47	Saskatchewan part	Saskatchewan	
300.2 - 48	Alberta part	Alberta	
300.2 - 59	British Columbia part	British Columbia	
300.2 - 61	Northwest Territories part	Northwest Territories	
300.3	Liard River:		
300.3 - 48	Alberta part	Alberta	
300.3 - 59	British Columbia part	British Columbia	
300.3 - 60	Yukon part	Yukon	
200.3 - 61	Northwest Territories part	Northwest Territories	
301	Athabasca River:		
301 - 47	Saskatchewan part	Saskatchewan	
301 - 48	Alberta part	Alberta	
302	Peace River:		
302 - 48	Alberta part	Alberta	
302 - 59	British Columbia part	British Columbia	
Arctic Ocean Coastal Drainage			
330.1	Mainland Arctic Coast Rivers:		
330.1 - 60	Yukon Part	Yukon	
330.1 - 61	Northwest Territories part	Northwest Territories	
330.2 - 61	Arctic Islands Rivers	Northwest Territories	

Appendix 1, Table 1

Drainage Basin Reference Codes (concluded)

Province		
4. PACIFIC OCEAN BASIN		
Columbia River Drainage		
400 - 59 Columbia River	British Columbia	
401 - 59 Okanagan River	British Columbia	
402 - 59 Similkameen River	British Columbia	
Fraser River Drainage		
410 - 59 Upper Fraser River	British Columbia	
411 - 59 Thompson River	British Columbia	
412 - 59 Lower Fraser River	British Columbia	
Yukon River Drainage		
420.1 Yukon River:		
420.1 - 59 British Columbia part	British Columbia	
420.1 - 60 Yukon part	Yukon	
420.2 - 60 Porcupine River	Yukon	
Pacific Ocean, North Coastal Drainage		
430 Alsek River:		
430 - 59 British Columbia part	British Columbia	
430 - 60 Yukon part	Yukon	
431.1 - 59 Pacific Ocean, North Coast Rivers	British Columbia	
431.2 - 59 Skeena River	British Columbia	
431.3 - 59 Queen Charlotte Islands Rivers	British Columbia	
Pacific Ocean, South Coastal Drainage		
432.1 - 59 Pacific Ocean, South Coast Rivers	British Columbia	
432.2 - 59 Northern Vancouver Island Rivers	British Columbia	
433 - 59 Southern Vancouver Island Rivers	British Columbia	
434 - 59 Skagit River	British Columbia	
5. GULF OF MEXICO BASIN		
Missouri River Drainage		
500 Milk - Missouri Tributary Rivers:		
500 - 47 Saskatchewan part	Saskatchewan	
500 - 48 Alberta part	Alberta	

Note:

Basin reference codes are made up of two elements, a first number which is the actual basin code and a second number which is the Statistics Canada code for the province. The provincial codes are as follows: 10 - Newfoundland, 11 - Prince Edward Island, 12 - Nova Scotia, 13 - New Brunswick, 24 - Québec, 35 - Ontario, 46 - Manitoba, 47 - Saskatchewan, 48 - Alberta, 59 - British Columbia, 60 - Yukon, 61 - Northwest Territories.

Appendix 1 Technical Box 2

Special Tabulations of Data for Ecozones and Drainage Basins

Many of the data presented here for ecozones and drainage basins were derived from Statistics Canada files through special tabulations of existing data. Several steps were involved in the preparation of these data series.

Ecozone and drainage basin boundaries were first transcribed to large scale maps. From these the boundaries of each unit were geocoded (i.e. assigned machine-readable x-y coordinates) by the Spatial Systems Section of the Geography Division, Statistics Canada. The resulting geographic file was matched to a file containing centroid coordinates of enumeration areas (EA'S), the basic data building block for Census of Population and Census of Agriculture information. A new file which contained a list of the constituent enumeration areas of each ecozone and drainage basin was then created.

Statistical tapes containing EA level information for the desired variables were accessed and the results tabulated to the ecozone and the basin levels.

A similar process was used to access information from the Census of Manufactures except that for these data series the municipality replaced the enumeration area as the basic data building block.

The special tabulations which appear in this book are illustrative of the flexibility Statistics Canada data bases possess for meeting information requirements for statistics on user-specified geographic units and special themes. More information regarding these services can be obtained from User Advisory Services.

Drainage Basin Comparability

In the first edition of *Human Activity and the Environment*, data were presented for a set of sixty-nine basins. In this publication statistics are presented for eighty-eight drainage basins, this increase resulting from the subdivision of some of the larger northern basins. These basins were split to reflect more accurately the geographic areas in which major resource projects were located.

To allow comparisons, the basin numbering system has remained consistent with that of the first edition. The basins which have been subdivided retained their original code number but now also carry an additional number which follows a decimal point.

References:

- Environment Canada, Lands Directorate, *Terrestrial Ecozones of Canada*, by E. Wiken, unpublished working paper, August, 1983.
- Statistics Canada, Office of the Senior Adviser on Integration, *Human Activity and the Environment*, Catalogue 11-509, 1978.
- Statistics Canada, Office of the Senior Adviser on Integration, *Thematic Maps of Man's Activities in Canada's Watersheds*, by B.W. Mitchell, uncatalogued publication, 1980.

Appendix 2, Table 1
Population and Population Density by Drainage Basin, 1971¹, 1976 and 1981

Code	Drainage Basin	Area	Population			Population Density ²			Percentage Change in Population	
			1971	1976	1981	1971	1976	1981	1971-1976	1976-1981
		square kilometres				persons/square kilometre				
1.	Atlantic Ocean Basin									
100.1-10	Labrador Coast Rivers	150 230	4 525	4 830	5 109	<1	<1	<1	6.7	5.8
100.2-10	Churchill and Naskaupi Rivers	110 715	21 670	25 908	23 750	<1	<1	<1	19.6	-8.3
101 -10	Newfoundland North Coast Rivers	48 510	125 840	132 766	133 798	3	3	3	5.5	0.8
102 -10	Trinity Bay Coastal Rivers	4 575	67 325	70 283	72 665	15	15	16	4.4	3.4
103 -10	St.John's area Rivers	2 935	144 960	156 645	165 843	49	53	57	8.1	5.9
104 -12	Nova Scotia, Southeast Coast Rivers	23 295	358 585	376 181	389 316	15	16	17	4.9	3.5
110.1	Gulf, Mainland North Coast Rivers:	184 640	73 700	88 931	90 590	<1	<1	<1	20.7	1.9
110.1-10	Labrador part	32 475	1 975	2 314	2 459	<1	<1	<1	17.2	6.3
110.1-24	Québec part	152 165	71 725	86 617	88 131	<1	1	1	20.8	1.7
110.2-24	Manicouagan and Outardes Rivers	68 370	23 510	24 898	23 659	<1	<1	<1	5.9	-5.0
110.3-24	Betsiamites River	28 915	17 700	16 150	16 203	1	1	1	-8.8	0.3
111 -10	Gulf, Newfoundland West and South Coast Rivers	56 280	155 810	164 979	164 057	3	3	3	5.9	-0.6
112 -24	North Gaspé Peninsula Rivers	12 245	148 630	147 751	153 970	12	12	13	-0.6	4.2
113	Gulf, Mainland South and West Coast Rivers:	62 860	386 700	401 060	410 365	6	6	7	3.7	2.3
113 -12	Nova Scotia part	7 015	75 310	79 133	81 073	11	11	12	5.1	2.5
113 -13	New Brunswick part	33 610	217 950	231 644	239 235	6	7	7	6.3	3.3
113 -24	Québec part	22 235	93 450	90 283	90 057	4	4	4	-3.4	-0.3
114 -11	Prince Edward Island Rivers	5 660	111 640	118 229	122 506	20	21	22	5.9	3.6
115 -12	Cape Breton Island Rivers	10 660	170 265	170 883	170 112	16	16	16	0.4	-0.5
120	Bay of Fundy Coast Rivers:	25 140	312 205	345 771	355 413	12	14	14	10.8	2.8
120 -12	Nova Scotia part	14 520	184 800	202 374	206 941	13	14	14	9.5	2.3
121 -13	New Brunswick part	10 620	127 405	143 397	148 472	12	14	14	12.6	3.5
130	Saint John River:	37 450	341 780	350 905	356 935	9	9	10	2.7	1.7
130 -13	New Brunswick part	29 210	289 205	302 209	308 696	10	10	11	4.5	2.1
130 -24	Québec part	8 240	52 575	48 696	48 239	6	6	6	-7.4	-0.9
140 -24	Saguenay River	87 970	267 215	270 977	287 272	3	3	3	1.4	6.0
141 -24	Québec City area - Middle North Shore Rivers	20 025	406 490	442 365	465 470	20	22	23	8.8	5.2
142 -24	Chaudière River - Middle South Shore Rivers	17 685	523 080	528 257	559 767	30	30	32	1.0	6.0
143 -24	St.Maurice River	45 405	126 675	127 701	131 975	3	3	3	0.8	3.3
144 -24	Eastern Township Rivers - Richelieu River	20 590	861 230	910 737	985 785	42	44	48	5.7	8.2
145 -24	Eastern Laurentian Rivers	9 445	169 025	193 979	221 367	18	21	23	14.8	14.1
146 -24	Montréal area Rivers	4 670	2 679 280	2 721 833	2 716 086	574	583	582	1.6	-0.2
147	West St. Lawrence River:	4 800	247 710	251 895	256 266	52	52	53	1.7	1.7
147 -24	Québec part	710	59 050	61 269	65 669	83	86	92	3.8	7.2
147 -35	Ontario part	4 090	188 665	190 626	190 597	46	47	47	1.0	0.0
150	Lower Ottawa River:	56 070	844 040	908 169	946 683	15	16	17	7.6	4.2
150 -24	Québec part	46 235	318 745	343 633	357 972	7	7	8	7.8	4.2
150 -35	Ontario part	9 835	525 290	564 536	588 711	53	57	60	7.5	4.3
151	Upper Ottawa River:	90 615	328 170	347 233	351 781	4	4	4	5.8	1.3
151 -24	Québec part	47 980	94 395	99 289	99 056	2	2	2	5.2	-0.2
151 -35	Ontario part	42 635	233 780	247 944	252 725	5	6	6	6.1	1.9
160 -35	Belleville-Napanee area Rivers	7 055	158 095	175 381	178 316	22	25	25	10.9	1.7
161 -35	Trent River	12 815	188 320	209 390	217 513	15	16	17	11.2	3.9
162 -35	Oshawa-Colborne area Rivers	1 910	164 170	185 895	197 523	86	97	103	13.2	6.3
163 -35	Toronto area Rivers	3 050	2 381 840	2 509 641	2 642 678	781	823	866	5.4	5.3
164 -35	Hamilton area Rivers	2 300	531 170	623 210	704 713	231	271	306	17.3	13.1
165 -35	Niagara Peninsula Rivers	2 565	560 710	600 787	611 132	219	234	238	7.1	1.7
170 -35	Grand River	7 035	502 555	556 008	582 983	71	79	83	10.6	4.9
171 -35	Lake Erie Shore Rivers	7 315	477 180	486 560	490 110	65	67	67	2.0	0.7
172 -35	Thames River	5 800	424 045	451 505	464 752	73	78	80	6.5	2.9
173 -35	Sydenham River	3 440	78 130	83 509	83 261	23	24	24	6.9	-0.3
180 -35	South Huron Shore Rivers	13 930	262 025	286 344	294 843	19	21	21	9.3	3.0
181 -35	Georgian Bay Shore - Lake Simcoe Shore Rivers	22 740	304 120	358 379	384 433	13	16	17	17.8	7.3
182 -35	North Huron Shore Rivers	55 850	367 040	368 152	371 843	7	7	7	0.3	1.0
190 -35	Lake Superior Shore Rivers	101 795	170 970	177 869	180 440	2	2	2	4.0	1.4
2.	Hudson Bay and Ungava Bay Basin									
200.1-24	East Hudson Bay Coast Rivers	198 075	1 780	1 651	2 925	<1	<1	<1	-7.2	77.2
200.2-24	Ungava Bay Coast Rivers	384 035	6 440	6 423	5 431	<1	<1	<1	-0.3	-15.4
200.3-24	Eastmain and LaGrande Rivers	163 430	2 080	4 130	5 738	<1	<1	<1	98.6	38.9
210.1-24	Rupert and Nottaway Rivers	137 955	30 385	32 776	34 172	<1	<1	<1	7.9	4.3
210.2	Harricaw River:	42 615	50 870	52 894	57 446	1	1	1	4.0	8.6
210.2-24	Québec part	26 320	47 460	50 204	54 538	2	2	2	5.8	8.6
210.2-35	Ontario part	16 295	3 410	2 690	2 908	<1	<1	<1	-21.1	8.1
210.3	Moose River:	112 290	124 880	123 944	123 309	1	1	1	-0.7	-0.5
210.3-24	Québec part	3 650	26 835	24 826	24 921	7	7	7	-7.5	0.4
210.3-35	Ontario part	108 640	98 050	99 118	98 388	1	1	1	1.1	-0.7
210.4-35	Albany River	100 195	5 115	5 584	5 688	<1	<1	<1	9.2	1.9
210.5	Southwest Hudson Bay Coast Rivers	325 920	4 660	5 589	7 266	<1	<1	<1	19.9	30.0
210.5-35	Ontario part	304 585	4 660	5 589	7 266	<1	<1	<1	19.9	30.0
210.5-46	Manitoba part	21 335	0	0	0	0	0	0		

Appendix 2 Table 1
Population and Population Density by Drainage Basin, 1971¹, 1976 and 1981 (continued)

Code	Drainage Basin	Area	Population			Population Density ²			Percentage Change in Population	
		square kilometres	1971	1976	1981	1971	1976	1981	1971-1976	1976-1981
						persons/square kilometre				
210.6	Hayes River:	107 935	4 580	5 709	5 142	<1	<1	<1	24.7	-9.9
210.6-35	Ontario part	15 880	0	0	0	0	0	0	...	...
210.6-46	Manitoba part	92 055	4 580	5 709	5 142	<1	<1	<1	24.7	-9.9
211.1	West Hudson Bay Coast Rivers:	427 165	4 745	4 482	5 060	<1	<1	<1	-5.5	12.9
211.1-46	Manitoba part	112 455	2 275	1 367	1 304	<1	<1	<1	-39.9	-4.6
211.1-47	Saskatchewan part	300	0	0	0	0	0	0	...	...
211.1-61	Northwest Territories part	314 410	2 470	3 115	3 756	<1	<1	<1	26.1	20.6
211.2	Thelon - Kazan Rivers:	243 935	755	882	954	<1	<1	<1	16.8	8.2
211.2-46	Manitoba part	795	0	0	0	0	0	0	...	...
211.2-47	Saskatchewan part	5 220	0	0	0	0	0	0	...	...
211.2-61	Northwest Territories part	237 920	755	882	954	<1	<1	<1	16.8	8.2
211.3	Churchill River:	282 520	60 775	64 199	70 096	<1	<1	<1	5.6	9.2
211.3-46	Manitoba part	93 790	6 040	8 251	6 625	<1	<1	<1	36.6	-19.7
211.3-47	Saskatchewan part	172 780	27 590	29 018	32 784	<1	<1	<1	5.2	13.0
211.3-48	Alberta part	15 950	27 145	26 930	30 687	2	2	2	-0.8	14.0
220 -46	Nelson River	90 365	30 255	30 897	26 276	<1	<1	<1	2.1	-15.0
230	Lake Winnipeg Shore Rivers:	227 845	116 475	115 643	114 465	1	1	1	-0.7	-1.0
230 -35	Ontario part	130 560	73 775	75 748	74 284	1	1	1	2.7	-1.9
230 -46	Manitoba part	97 285	42 695	39 895	40 181	<1	<1	<1	-6.6	0.7
231 -46	Red River	25 620	552 295	578 561	596 164	22	23	23	4.8	3.0
232	Dauphin River:	83 510	106 770	104 475	101 918	1	1	1	-2.1	-2.4
232 -46	Manitoba part	65 245	85 085	83 088	81 308	1	1	1	-2.3	-2.1
232 -47	Saskatchewan part	18 265	21 685	21 387	20 610	1	1	1	-1.4	-3.6
240	Assiniboine and Souris Rivers:	90 245	390 670	389 688	381 819	4	4	4	-0.3	-2.0
240 -46	Manitoba part	31 595	243 045	251 641	247 264	8	8	8	3.5	-1.7
240 -47	Saskatchewan part	58 650	147 630	138 047	134 555	3	2	2	-6.5	-2.5
241	Qu'Appelle River - Old Wives Lake:	71 600	304 700	308 829	323 383	4	4	5	1.4	4.7
241 -46	Manitoba part	70	0	0	0	0	0	0	...	...
241 -47	Saskatchewan part	71 530	304 700	308 829	323 383	4	4	5	1.4	4.7
250	Saskatchewan River:	78 730	71 040	70 596	70 011	1	1	1	-0.6	-0.8
250 -46	Manitoba part	19 340	21 980	22 097	21 977	1	1	1	0.5	-0.5
250 -47	Saskatchewan part	59 390	49 060	48 499	48 034	1	1	1	-1.1	-1.0
251 -48	Upper North Saskatchewan River	28 065	176 910	199 546	235 955	6	7	8	12.8	18.2
252	Lower North Saskatchewan River:	124 750	670 065	725 627	844 808	5	6	7	8.3	16.4
252 -47	Saskatchewan part	57 030	140 505	138 019	143 099	2	2	3	-1.8	3.7
252 -48	Alberta part	67 720	529 565	587 608	701 709	8	9	10	11.0	19.4
253	South Saskatchewan River and Red Deer River:	152 575	500 685	534 742	614 247	3	4	4	6.8	14.9
253 -47	Saskatchewan part	56 970	220 150	224 049	251 133	4	4	4	1.8	12.1
253 -48	Alberta part	95 605	280 535	310 693	363 114	3	3	4	10.8	16.9
254 -48	Bow River	24 980	447 520	524 318	668 857	18	21	27	17.2	27.6
3.	Arctic Ocean Basin									
300.1	Mackenzie River:	544 765	6 900	8 543	8 517	<1	<1	<1	23.8	-0.3
300.1-60	Yukon part	68 530	0	0	0	0	0	0	...	...
300.1-61	Northwest Territories part	476 235	6 900	8 543	8 517	<1	<1	<1	23.8	-0.3
300.2	Great Slave Lake Shore Rivers:	496 915	21 065	25 278	27 089	<1	<1	<1	20.0	7.2
300.2-47	Saskatchewan part	114 900	3 400	3 480	4 392	<1	<1	<1	2.4	26.2
300.2-48	Alberta part	76 265	2 575	2 851	2 845	<1	<1	<1	10.7	-0.2
300.2-59	British Columbia part	8 065	495	488	473	<1	<1	<1	-1.4	-3.1
300.2-61	Northwest Territories part	297 685	14 595	18 459	19 379	<1	<1	<1	26.5	5.0
300.3	Liard River:	273 915	6 220	6 972	8 373	<1	<1	<1	12.1	20.1
300.3-48	Alberta part	9 035	0	0	0	0	0	0	...	...
300.3-59	British Columbia part	142 545	4 485	4 959	6 316	<1	<1	<1	10.6	27.4
300.3-60	Yukon part	60 670	1 120	1 394	1 247	<1	<1	<1	24.5	-10.5
300.3-61	Northwest Territories part	61 665	610	619	810	<1	<1	<1	1.5	30.9
301	Athabasca River:	160 690	78 740	94 231	123 969	<1	1	1	19.7	31.6
301 -47	Saskatchewan part	16 720	0	8	17	0	<1	<1	...	112.5
301 -48	Alberta part	143 970	78 740	94 223	123 952	1	1	1	19.7	31.6
302	Peace River:	319 080	125 380	135 796	164 799	<1	<1	1	8.3	21.4
302 -48	Alberta part	194 040	81 750	89 011	107 816	<1	<1	1	8.9	21.1
302 -59	British Columbia part	125 040	43 630	46 785	56 983	<1	<1	<1	7.2	21.8
330.1	Mainland Arctic Coast Rivers:	707 725	3 050	3 734	4 217	<1	<1	<1	22.4	12.9
330.1-60	Yukon part	16 120	0	4	1	0	<1	<1	...	-75.0
330.1-61	Northwest Territories part	691 605	3 050	3 730	4 216	<1	<1	<1	22.3	13.0
330.2-61	Arctic Islands Rivers	1 346 800	6 420	7 261	8 109	<1	<1	<1	13.1	11.7
4.	Pacific Ocean Basin									
400 -59	Columbia River	88 960	132 155	142 607	155 306	1	2	2	7.9	8.9
401 -59	Okanagan River	7 820	113 425	153 334	178 079	15	20	23	35.2	16.1
402 -59	Similkameen River	7 155	6 800	8 262	8 730	1	1	1	21.5	5.7
410 -59	Upper Fraser River	172 820	154 290	188 164	211 080	1	1	1	22.0	12.2
411 -59	Thompson River	56 570	100 630	125 816	143 383	2	2	3	25.0	14.0
412 -59	Lower Fraser River	5 745	899 210	992 532	1 110 808	157	173	193	10.4	11.9

Appendix 2 Table 1

Population and Population Density by Drainage Basin, 1971¹, 1976 and 1981 (concluded)

Code	Drainage Basin	Area	Population			Population Density ²			Percentage Change in Population	
			1971	1976	1981	1971	1976	1981	1971-1976	1976-1981
		square kilometres				persons/square kilometre				
420.1	Yukon River:	272 985	16 985	20 504	21 698	<1	<1	<1	20.7	5.8
420.1-59	British Columbia part	24 075	310	558	402	<1	<1	<1	80.0	-28.0
420.1-60	Yukon part	248 910	16 680	19 946	21 296	<1	<1	<1	19.6	6.8
420.2-60	Porcupine River	61 820	215	224	243	<1	<1	<1	4.2	8.5
430	Alsek River:	38 605	375	268	366	<1	<1	<1	-28.5	36.6
430 -59	British Columbia part	11 205	0	0	0	0	0	0	...	...
430 -60	Yukon part	27 400	375	268	366	<1	<1	<1	-28.5	36.6
431.1-59	Pacific Ocean, North Coast Rivers	154 575	22 285	21 836	22 480	<1	<1	<1	-2.0	2.9
431.2-59	Skeena River	55 245	48 720	52 467	59 264	1	1	1	7.7	13.0
431.3-59	Queen Charlotte Islands Rivers	9 695	4 355	5 509	5 621	<1	1	1	26.5	2.0
432.1-59	Pacific Ocean, South Coast Rivers	44 560	272 055	281 074	288 849	6	6	6	3.3	2.8
432.2-59	Northern Vancouver Island Rivers	27 925	144 020	170 904	201 728	5	6	7	18.7	18.0
433 -59	Southern Vancouver Island Rivers	4 850	237 755	271 313	294 964	49	56	61	14.1	8.7
434 -59	Skagit River	950	0	0	1	0	0	<1		
5.	Gulf of Mexico Basin									
500	Milk - Missouri Tributary Rivers:	26 135	14 660	12 844	13 095	1	<1	1	-12.4	2.0
500 -47	Saskatchewan part	20 575	11 525	9 987	10 306	1	<1	1	-13.3	3.2
500 -48	Alberta part	5 560	3 135	2 857	2 789	1	1	1	-8.9	-2.4
Canada³		9 848 015	21 568 310	22 992 604	24 343 181	2	2	2	6.6	5.9

¹ The 1971 Census figures have been random rounded. Since they have been rounded independently, individual items may not add exactly to totals.

² <1 indicates that the population density is less than 1 when rounded to the nearest whole number.

³ The Canada area total in this table corresponds to the area total of all the drainage basins. However, there is a difference of 122 595 square kilometres between the Canada area total of this Table and the total shown in Table 2.1.4. This is because the drainage basins in this Table exclude the following water bodies:

Gulf of St. Lawrence - 28 000 square kilometres,
 St. Lawrence River - 6 330 square kilometres,
 Lake Ontario - Canadian Portion - 10 050 square kilometres,
 Lake St. Clair - Canadian Portion - 695 square kilometres,
 Lake Erie - Canadian Portion - 12 770 square kilometres,
 Lake Huron - Canadian Portion - 36 000 square kilometres,
 Lake Superior - Canadian Portion - 28 750 square kilometres.

Source:

Statistics Canada, Census of Population, 1971, 1976 and 1981, special tabulations by the Office of the Senior Adviser of Integration.

Appendix 3, Table 1

Monoculture Farms by Drainage Basin 1971, 1976 and 1981

Drainage Basin	Wide-row				Close-row			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number			percent	number			percent
1. Atlantic Ocean Basin								
100.1-10 Labrador Coast Rivers	0	0	1	...	0	0	0	...
100.2-10 Churchill and Naskaupi Rivers	0	0	2	...	0	0	0	...
101 -10 Newfoundland, North Coast Rivers	48	48	51	6.3	1	1	1	0
102 -10 Trinity Bay Coast Rivers	21	32	16	-23.8	2	2	2	0
103 -10 St. John's area Rivers	21	24	21	0	1	0	1	0
104 -12 Nova Scotia, Southeast Coast Rivers	19	24	25	31.6	35	26	14	-60.0
110.1 Gulf, Mainland North Coast Rivers:	4	19	12	200.0	4	9	8	100.0
100.1-10 Labrador part	0	0	1	...	0	0	0	...
110.1-24 Québec part	4	19	11	175.0	4	9	8	100.0
110.2-24 Manicouagan and Outardes Rivers	6	2	7	...	3	2	0	-100.0
110.3-24 Betsiamites River	0	1	4	...	11	4	2	-81.8
111 -10 Gulf, Newfoundland West and South Coast Rivers	29	26	26	-10.3	1	5	1	0
112 -24 North Gaspé Peninsula Rivers	9	21	25	177.8	233	106	121	-48.1
113 Gulf, Mainland South and West Coast Rivers:	114	99	73	-36.0	388	230	169	-56.4
113 -12 Nova Scotia part	14	11	9	-35.7	82	74	46	-43.9
113 -13 New Brunswick part	84	63	47	-44.0	174	96	44	-74.7
113 -24 Québec part	16	25	17	6.3	132	60	79	-40.2
114 -11 Prince Edward Island Rivers	125	81	93	-25.6	402	261	300	-25.4
115 -12 Cape Breton Island Rivers	9	4	8	-11.1	25	26	5	-80.0
120 Bay of Fundy Coast Rivers:	90	80	85	-5.6	161	101	87	-46.0
120 -12 Nova Scotia part	80	70	74	-7.5	124	80	71	-42.7
121 -13 New Brunswick part	10	10	11	10.0	37	21	16	-56.8
130 Saint John River:	328	241	180	-45.1	374	214	161	-57.0
130 -13 New Brunswick part	320	238	171	-46.6	209	133	91	-56.5
130 -24 Québec part	8	3	9	12.5	165	81	70	-57.6
140 -24 Saguenay River	29	32	26	-10.3	320	163	161	-49.7
141 -24 Québec City area - Middle North Shore Rivers	76	78	104	36.8	312	167	181	-42.0
142 -24 Chaudière River - Middle South Shore Rivers	55	50	111	101.8	1051	573	664	-36.8
143 -24 St. Maurice River	18	13	20	11.1	21	14	11	-47.6
144 -24 Eastern Township Rivers - Richelieu River	645	606	1 159	79.7	925	701	789	-14.7
145 -24 Eastern Laurentian Rivers	201	226	267	32.8	319	248	276	-13.5
146 -24 Montreal area Rivers	651	607	743	14.1	216	161	215	-0.5
147 West St. Lawrence River:	94	122	220	134.0	119	87	106	-10.9
147 -24 Québec part	40	46	103	157.5	23	26	37	60.9
147 -35 Ontario part	54	76	117	116.7	96	61	69	-28.1
150 Lower Ottawa River:	324	262	358	10.5	454	338	357	-21.4
150 -24 Québec part	64	49	58	-9.4	204	126	146	-28.4
150 -35 Ontario part	260	213	300	15.4	250	212	211	-15.6
151 Upper Ottawa River:	77	108	105	36.4	344	239	249	-27.6
151 -24 Québec part	31	33	26	-16.1	119	75	64	-46.2
151 -35 Ontario part	46	75	79	71.7	225	164	185	-17.8
160 -35 Belleville-Napanee area Rivers	89	103	137	53.9	139	136	100	-28.1
161 -35 Trent River	128	171	287	124.2	285	214	205	-28.1
162 -35 Oshawa-Colborne area Rivers	147	139	204	38.8	80	83	77	-3.8
163 -35 Toronto area Rivers	160	175	202	26.3	213	190	124	-41.8
164 -35 Hamilton area Rivers	224	238	213	-4.9	170	161	115	-32.4
165 -35 Niagara Peninsula Rivers	166	189	254	53.0	235	204	210	-10.6
170 -35 Grand River	717	844	997	39.1	723	677	626	-13.4
171 -35 Lake Erie Shore Rivers	3 788	3 078	3 549	-6.3	337	375	245	-27.3
172 -35 Thames River	1 938	1 813	2 370	22.3	337	293	179	-46.9
173 -35 Sydenham River	1 287	1 190	1 706	32.6	110	107	84	-23.6
180 -35 South Huron Shore Rivers	641	823	1 194	86.3	737	584	597	-19.0
181 -35 Georgian Bay Shore - Lake Simcoe Shore Rivers	537	536	589	9.7	407	313	264	-35.1
182 -35 North Huron Shore Rivers	29	43	49	69.0	100	121	64	-36.0
190 -35 Lake Superior Shore Rivers	18	21	19	5.6	19	33	16	-15.8
2. Hudson Bay and Ungava Bay Basin								
200.1-24 East Hudson Bay Coast Rivers	0	0	0	...	0	0	0	...
200.2-24 Ungava Bay Coast Rivers	0	0	0	...	0	0	0	...
200.3-24 Eastmain and LaGrande Rivers	0	0	0	...	0	0	0	...
210.1-24 Rupert and Nottaway Rivers	0	1	1	...	4	8	3	-25.0
210.2 Harricnaw River:	3	8	7	133.3	48	31	17	-64.6
210.2-24 Québec part	3	8	7	133.3	48	31	17	-64.6
210.2-35 Ontario part	0	0	0	...	0	0	0	...
210.3 Moose River:	13	13	16	23.1	91	56	34	-62.6
210.3-24 Québec part	1	2	5	400.0	63	34	18	-71.4
210.3-35 Ontario part	12	11	11	-8.3	28	22	16	-42.9
210.4-35 Albany River	0	0	0	...	0	0	0	...
210.5 Southwest Hudson Bay Coast Rivers:	0	0	0	...	0	0	0	...
210.5-35 Ontario part	0	0	0	...	0	0	0	...
210.5-46 Manitoba part	0	0	0	...	0	0	0	...

Appendix 3, Table 1

Monoculture Farms by Drainage Basin 1971, 1976 and 1981 (continued)

Drainage Basin	Wide-row				Close-row			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number			percent	number			percent
210.6 Hayes River:	0	0	0	...	0	0	0	
210.6-35 Ontario part	0	0	0	...	0	0	0	
210.6-46 Manitoba part	0	0	0	...	0	0	0	
211.1 West Hudson Bay Coast Rivers:	0	0	0	...	0	0	0	
211.1-46 Manitoba part	0	0	0	...	0	0	0	
211.1-47 Saskatchewan part	0	0	0	...	0	0	0	
211.1-61 Northwest Territories part	0	0	0	...	0	0	0	
211.2 Thelon - Kazan Rivers:	0	0	0	...	0	0	0	
211.2-46 Manitoba part	0	0	0	...	0	0	0	
211.2-47 Saskatchewan part	0	0	0	...	0	0	0	
211.2-61 Northwest Territories part	0	0	0	...	0	0	0	
211.3 Churchill River:	4	1	1	-75.0	1 415	922	1 192	-15.8
211.3-46 Manitoba part	0	0	0	...	0	0	0	
211.3-47 Saskatchewan part	4	0	1	-75.0	896	627	735	-18.0
211.3-48 Alberta part	0	0	2	...	519	295	457	-11.9
220 -46 Nelson River	0	0	1	...	0	0	1	
230 Lake Winnipeg Shore Rivers:	8	9	15	87.5	1 313	883	957	-27.1
230 -35 Ontario part	2	2	4	100.0	40	39	41	2.5
230 -46 Manitoba part	6	7	11	83.3	1 273	844	916	-28.0
231 -46 Red River	136	105	164	20.6	6 931	6 605	5 119	-26.1
232 Dauphin River:	10	13	34	240.0	8 256	6 353	6 046	-26.8
232 -46 Manitoba part	7	11	31	342.9	5 579	4 285	3 944	-29.3
232 -47 Saskatchewan part	3	2	3	0.0	2 677	2 068	2 102	-21.5
240 Assiniboine and Souris Rivers:	36	31	51	41.7	23 788	20 082	18 770	-21.1
240 -46 Manitoba part	30	19	39	30.0	7 735	6 445	5 801	-25.0
240 -47 Saskatchewan part	6	12	12	100.0	16 053	13 637	12 969	-19.2
241 Qu'Appelle River - Old Wives Lake:	20	16	20	0	17 707	1 400	15 820	-10.7
241 -46 Manitoba part	0	0	0	...	0	0	0	
241 -47 Saskatchewan part	20	16	20	0	17 707	16 140	15 820	10.7
250 Saskatchewan River:	4	1	3	-25.0	4 400	3 878	3 807	-13.5
250 -46 Manitoba part	2	1	2	0	68	59	71	4.4
250 -47 Saskatchewan part	2	0	1	-50.0	4 332	3 819	3 736	-13.8
251 -48 Upper North Saskatchewan River	6	14	10	66.7	939	822	682	-27.4
252 Lower North Saskatchewan River:	40	37	51	27.5	24 898	20 824	20 980	-15.7
252 -47 Saskatchewan part	5	8	12	140.0	11 278	9 855	9 866	-12.5
252 -48 Albert part	35	29	39	11.4	13 620	10 969	11 114	-18.4
253 South Saskatchewan River and Red Deer River:	78	66	69	-11.5	21 104	18 980	18 634	-11.7
253 -47 Saskatchewan part	17	9	26	52.9	10 911	9 809	9 263	-15.1
253 -48 Alberta part	61	57	43	-29.5	10 193	9 171	9 371	-8.1
254 -48 Bow River	11	11	8	-27.3	1 487	1 301	1 329	-10.6
3. Arctic Ocean Basin								
300.1 Mackenzie River:	0	0	0	...	0	0	0	
300.1-60 Yukon part	0	0	0	...	0	0	0	
300.1-61 Northwest Territories part	0	0	0	...	0	0	0	
300.2 Great Slave Lake Shore Rivers:	0	0	0	...	0	0	1	
300.2-47 Saskatchewan part	0	0	0	...	0	0	0	
300.2-48 Alberta part	0	0	0	...	0	0	1	
300.2-59 British Columbia part	0	0	0	...	0	0	0	
300.2-61 Northwest Territories part	0	0	0	...	0	0	0	
300.3 Liard River:	0	0	0	...	0	0	1	
300.3-48 Alberta part	0	0	0	...	0	0	0	
300.3-59 British Columbia part	0	0	0	...	0	0	1	
300.3-60 Yukon part	0	0	0	...	0	0	0	
300.3-61 Northwest Territories part	0	0	0	...	0	0	0	
301 Athabasca River:	2	8	8	300.0	1 853	1 225	1 305	-29.6
301 -47 Saskatchewan part	0	0	0	...	0	0	0	
301 -48 Alberta part	2	8	8	300.0	1 853	1 225	1 305	-29.6
302 Peace River:	17	13	19	11.8	4 698	4 849	5 047	7.4
302 -48 Alberta part	9	8	10	11.1	3 965	4 273	4 448	12.2
302 -59 British Columbia part	8	5	9	12.5	733	576	599	18.3
330.1 Mainland Arctic Coast Rivers:	0	0	0	...	0	0	0	
330.1-60 Yukon part	0	0	0	...	0	0	0	
330.1-61 Northwest Territories part	0	0	0	...	0	0	0	
330.2-61 Arctic Islands Rivers	0	0	0	...	0	0	0	
4. Pacific Ocean Basin								
400 -59 Columbia River	15	22	20	33.3	48	55	42	12.5
401 -59 Okanagan River	70	80	71	1.4	53	48	67	26.4
402 -59 Similkameen River	5	6	4	-20.0	3	2	2	-33.3
410 -59 Upper Fraser River	71	66	63	-11.3	65	86	64	-1.5
411 -59 Thompson River	17	23	40	135.3	49	48	53	8.2
412 -59 Lower Fraser River	199	194	224	12.6	112	72	40	-64.3

Appendix 3, Table 1

Monoculture Farms by Drainage Basin 1971, 1976 and 1981 (concluded)

Drainage Basin	Wide-row				Close-row			
	1971	1976	1981	Change 1971 to 1981	1971	1976	1981	Change 1971 to 1981
	number	number	number	percent	number	number	number	percent
420.1 Yukon River:	0	0	0	...	0	0	0	...
420.1-59 British Columbia part	0	0	0	...	0	0	0	...
420.1-60 Yukon part	0	0	0	...	0	0	0	...
420.2-60 Porcupine River	0	0	0	...	0	0	0	...
430 Alsek River:	0	0	0	...	0	0	0	...
430 -59 British Columbia part	0	0	0	...	0	0	0	...
430 -60 Yukon part	0	0	0	...	0	0	0	...
431.1-59 Pacific Ocean, North Coast Rivers	0	0	2	...	1	0	2	100.0
431.2-59 Skeena River	11	14	9	-18.2	8	21	11	37.5
431.3-59 Queen Charlotte Islands Rivers	0	1	1	...	2	0	1	-50.0
432.1-59 Pacific Ocean, South Coast Rivers	1	6	1	0	3	4	2	-33.3
432.2-59 Northern Vancouver Island Rivers	18	25	34	88.9	21	32	11	-47.6
433 -59 Southern Vancouver Island Rivers	29	33	29	0	23	20	28	21.7
434 -59 Skagit River	0	0	0	...	0	0	0	...
5. Gulf of Mexico Basin								
500 Milk - Missouri Tributary Rivers:	0	0	0	...	2 062	1 755	1 775	-13.9
500 -47 Saskatchewan part	0	0	0	...	1 721	1 471	1 491	-13.4
500 -48 Alberta part	0	0	0	...	341	284	284	-16.7
Canada	13 686	12 986	16 488	20.5	130 996	112 271	108 628	-17.1

¹ Monoculture is defined as the planting of one crop type on a continuous year to year basis. Monoculture farms in the above table are farms where eighty percent of cropland is under one crop type. For more detail see Technical Box 3.1.17.

Source:

Statistics Canada, Census of Agriculture 1971, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

Note:

Disaggregations of tables in Chapter 3.1 to the drainage basin level are available on special request.

Appendix 4, Table 1

Estimated Efficiency Rating of Energy Forms by Use¹

Fuel	Residential	Commercial	Industrial	Transportation			
				Road	Rail	Air	Marine
				percent	percent	percent	percent
Coal, Coke	50	65	87	...	8	...	8
Liquid Propane Gas	75	78	85	...	...	...	...
Still Gas	...	...	85	...	...	...	...
Kerosene	55	82	82	...	55	...	55
Diesel Oil	23	23	26	23	23	...	15
Light Fuel Oil	65	82	82	...	82	...	10
Heavy Fuel Oil	80	80	87	...	80	...	10
Motor Gasoline	...	...	...	20	...	...	...
Aviation Gas	...	...	...	...	...	20	...
Aviation Turbofuel	...	...	...	...	...	30	...
Natural Gas	75	78	85	...	...	...	...
Electricity	100	100	100	...	...	...	...
Petroleum Coke	...	...	87	...	...	...	...
Crude Oil	...	...	87	...	...	...	...
Coke Oven Gas	...	...	85	...	...	...	...
Wood and Wood Residue	50	50	50	...	...	...	...

¹ The efficiency rating of a fuel is the percentage of its per unit energy content that performs the work or function at hand. The remaining proportion is essentially wasted. For example, when aviation gas is consumed to provide motive power for an aircraft, only twenty percent of its energy content is used for that purpose; the other eighty percent is transformed largely to heat energy and goes unused.

Source:

Energy, Mines and Resources Canada *Energy Demand Projections, A Total Energy Approach*, Ottawa, 1977.

Appendix 5 Table 1
Large Dams¹ by Drainage Basin, 1982

		Primary Purpose of Dam ²				Total
		Irrigation	Hydro-Power	Water Supply	Water Control, Navigation, Recreation	
		number of dams				
Atlantic Ocean Basin						
100.1 - 10	Labrador Coast Rivers	0	1	0	0	1
100.2 - 10	Churchill and Naskaupi Rivers	0	38 ³	0	0	38 ³
101 - 10	Newfoundland, North Coast Rivers	0	3	0	0	3
102 - 10	Trinity Bay Coast Rivers	0	2	0	0	2
103 - 10	St. John's area Rivers	0	1	0	0	1
104 - 12	Nova Scotia, Southeast Coast Rivers	0	9	0	0	9
110.1	Gulf, Mainland North Coast Rivers:					
110.1 - 10	Labrador part	0	0	0	0	0
110.1 - 24	Québec part	0	1	0	0	1
110.2 - 24	Manicouagou and Outardes Rivers	0	20 ⁴	0	0	20 ⁴
110.3 - 24	Betsiamites River	0	5	0	0	5
111 - 10	Gulf, Newfoundland West and South Coast Rivers	0	11	0	0	11
112 - 24	North Gaspé Peninsula Rivers	0	2	0	1	3
113	Gulf, Mainland South and West Coast Rivers:					
113 - 12	Nova Scotia part	0	0	2	0	2
113 - 13	New Brunswick part	0	0	2	0	2
113 - 24	Québec part	0	1	0	0	1
114 - 11	Prince Edward Island Rivers	0	0	0	0	0
115 - 12	Cape Breton Island Rivers	0	7	0	0	7
120	Bay of Fundy Coast Rivers:					
120 - 12	Nova Scotia part	1	13	0	1	15
121 - 13	New Brunswick part	0	3	1	2	6
130	Saint John River:					
130 - 13	New Brunswick part	0	7	0	0	7
130 - 24	Québec part	0	0	0	0	0
140 - 24	Saguenay River	0	21 ⁵	1	0	22 ⁵
141 - 24	Québec City area — Middle North Shore Rivers	0	3	0	0	3
142 - 24	Chaudière River — Middle South Shore Rivers	0	1	0	1	2
143 - 24	St. Maurice River	0	8	0	0	8
144 - 24	Eastern Townships Rivers — Richelieu River	0	4	0	0	4
145 - 24	Eastern Laurentians Rivers	0	0	0	0	0
146 - 24	Montreal area Rivers	0	1	0	0	1
147	West St. Lawrence River:					
147 - 24	Quebec part	0	6	0	2	8
147 - 35	Ontario part	0	2	0	1	3
150	Lower Ottawa River:					
150 - 24	Québec part	0	17	0	0	17
150 - 35	Ontario part	0	0	0	0	0
151	Upper Ottawa River:					
151 - 24	Québec part	0	7	0	0	7
151 - 35	Ontario part	0	15	0	0	15
160 - 35	Belleville — Napanee area Rivers	0	0	0	1	1
161 - 35	Trent River	0	1	0	0	1
162 - 35	Oshawa — Colborne area Rivers	0	0	0	0	0
163 - 35	Toronto area Rivers	0	0	0	1	1
164 - 35	Hamilton area Rivers	0	0	0	1	1
165 - 35	Niagara Peninsula Rivers	0	3	0	0	3
170 - 35	Grand River	0	0	0	2	2
171 - 35	Lake Erie Shore Rivers	0	0	0	0	0
172 - 35	Thames River	0	0	1	3	4
173 - 35	Sydenham River	0	0	0	0	0
180 - 35	South Huron Shore Rivers	0	1	1	1	3
181 - 35	Georgian Bay Shore — Lake Simcoe Shore Rivers	0	1	0	0	1
182 - 35	North Huron Shore Rivers	0	9	0	0	9
190 - 35	Lake Superior Shore Rivers	0	12	0	0	12
Hudson Bay and Ungava Bay Basin						
200.1 - 24	East Hudson Bay Coast Rivers	0	0	0	0	0
200.2 - 24	Ungava Bay Coast Rivers	0	24 ⁶	0	0	24 ⁶
200.3 - 24	Eastmain and LaGrande Rivers	0	57 ⁷	0	0	57 ⁷
210.1 - 24	Rupert and Nottaway Rivers	0	0	0	0	0
210.2	Harricanaw River:					
210.2 - 24	Québec part	0	0	0	0	0
210.2 - 35	Ontario part	0	0	0	0	0
210.3	Moose River:					
210.3 - 24	Quebec part	0	0	0	0	0
210.3 - 35	Ontario part	0	12	0	0	12
210.4 - 35	Albany River	0	0	0	0	0
210.5	Southwest Hudson Bay Coast Rivers:					
210.5 - 35	Ontario part	0	0	0	0	0
210.5 - 46	Manitoba part	0	0	0	0	0
210.6	Hayes River:					
210.6 - 35	Ontario part	0	0	0	0	0
210.6 - 46	Manitoba part	0	0	0	0	0

Appendix 5 Table 1
Large Dams¹ by Drainage Basin, 1982 (continued)

		Primary Purpose of Dam ²				Total
		Irrigation	Hydro-Power	Water Supply	Water Control, Navigation, Recreation	
		number of dams				
211.1	West Hudson Bay Coast Rivers:					
211.1 - 46	Manitoba part	0	0	0	0	0
211.1 - 47	Saskatchewan part	0	0	0	0	0
211.1 - 61	Northwest Territories part	0	0	0	0	0
211.2	Thelon - Kazan Rivers:					
211.2 - 46	Manitoba part	0	0	0	0	0
211.2 - 47	Saskatchewan part	0	0	0	0	0
211.2 - 61	Northwest Territories part	0	0	0	0	0
211.3	Churchill River:					
211.3 - 46	Manitoba part	0	4	0	0	4
211.3 - 47	Saskatchewan part	0	2	0	0	2
211.3 - 48	Alberta part	0	0	0	0	0
220 - 46	Nelson River	0	14 ^a	0	0	14 ^a
230	Lake Winnipeg Shore Rivers:					
230 - 35	Ontario part	0	5	0	4	9
230 - 46	Manitoba part	0	6	0	0	6
231 - 46	Red River	0	0	2	2	4
232	Dauphin River:					
232 - 46	Manitoba part	0	0	1	0	1
232 - 47	Saskatchewan part	0	0	0	0	0
240	Assiniboine and Souris Rivers:					
240 - 46	Manitoba part	1	0	1	2	4
240 - 47	Saskatchewan part	2	0	4	0	6
241	Qu'Appelle River - Old Wives Lake:					
241 - 46	Manitoba part	0	0	0	0	0
241 - 47	Saskatchewan part	8	0	1	1	10
250	Saskatchewan River:					
250 - 46	Manitoba part	0	1	0	0	1
250 - 47	Saskatchewan part	0	1	1	0	2
251 - 48	Upper North Saskatchewan River	0	4	0	0	4
252	Lower North Saskatchewan River:					
252 - 47	Saskatchewan part	0	0	0	0	0
252 - 48	Alberta part	0	0	1	0	1
253	South Saskatchewan River and Red Deer River:					
253 - 47	Saskatchewan part	9	0	1	1	11
253 - 48	Alberta part	16	0	1	3	20
254 - 48	Bow River	5	14	1	0	20
Arctic Ocean Basin						
300.1	Mackenzie River:					
300.1 - 60	Yukon part	0	0	0	0	0
300.1 - 61	Northwest Territories part	0	0	0	0	0
300.2	Great Slave Lake Shore Rivers:					
300.2 - 47	Saskatchewan part	0	1	0	0	1
300.2 - 48	Alberta part	0	0	0	0	0
300.2 - 59	British Columbia part	0	0	0	0	0
300.2 - 61	Northwest Territories part	0	3	0	0	3
300.3	Liard River:					
300.3 - 48	Alberta part	0	0	0	0	0
300.3 - 59	British Columbia part	0	0	0	0	0
300.3 - 60	Yukon part	0	0	0	0	0
300.3 - 61	Northwest Territories part	0	0	0	0	0
301	Athabasca River:					
301 - 47	Saskatchewan part	0	0	0	0	0
301 - 48	Alberta part	0	0	0	0	0
302	Peace River:					
302 - 48	Alberta part	0	1	0	0	1
302 - 59	British Columbia part	0	2	0	0	2
330.1	Mainland Arctic Coast Rivers:					
330.1 - 60	Yukon part	0	0	0	0	0
330.1 - 61	Northwest Territories part	0	0	0	0	0
330.2 - 61	Arctic Islands Rivers	0	0	0	0	0
Pacific Ocean Basin						
400 - 59	Columbia River	0	15	2	0	17
401 - 59	Okanagan River	12	2	1	0	15
402 - 59	Similkameen River	0	0	0	0	0
410 - 59	Upper Fraser River	0	5	2	0	7
411 - 59	Thompson River	1	0	0	0	1
412 - 59	Lower Fraser River	0	6	0	0	6
420.1	Yukon River:					
420.1 - 59	British Columbia part	0	0	0	0	0
420.1 - 60	Yukon part	0	2	0	0	2
420.2 - 60	Porcupine River	0	0	0	0	0
430	Alsek River:					
430 - 59	British Columbia part	0	0	0	0	0
430 - 60	Yukon part	0	0	0	0	0

Appendix 5 Table 1

Large Dams¹ by Drainage Basin, 1982 (concluded)

		Primary Purpose of Dam ²				Total
		Irrigation	Hydro-Power	Water Supply	Water Control, Navigation, Recreation	
		number of dams				
431.1 - 59	Pacific Ocean, North Coast Rivers	0	1	1	0	2
431.2 - 59	Skeena River	0	3	3	0	6
431.3 - 59	Queen Charlotte Islands Rivers	0	0	0	0	0
432.1 - 59	Pacific Ocean, South Coast Rivers	0	9	3	0	12
432.2 - 59	Northern Vancouver Island Rivers	0	7	5	1	13
433 - 59	Southern Vancouver Island Rivers	0	3	6	0	9
434 - 59	Skagit River	0	0	0	0	0
Gulf of Mexico Basin						
500	Milk-Missouri Tributary Rivers:					
500 - 47	Saskatchewan part	1	0	0	1	2
500 - 48	Alberta part	0	0	0	0	0

¹ Large dams are defined by the International Commission on Large Dams as any dam higher than 15 metres, as well as any dams between 10 and 15 metres in height, provided one of the following conditions is met: a) length of crest > 500 metres, b) reservoir capacity > 1 million cubic metres, c) maximum discharge > 2000 cubic metres/second, d) dam has specially difficult foundation problems, e) dam is of unusual design.

² The primary purpose of the dam is used here for classification. Some dams, however, may serve several purposes, for example, a hydro dam may also control water levels in a supply reservoir.

³ Thirty-six of these dams are components of the Churchill Falls Power Project.

⁴ Six of these dams are components of the Outardes 4 Power Project; some of the other dams are components of multiple dam projects.

⁵ Six of these dams are components of the Isle Maligne Power Project.

⁶ These are all component dams and dykes of the James Bay Power Project.

⁷ These are all component dams and dykes of the James Bay Power Project.

⁸ Seven of these dams are components of the Kettle Rapids Power Project; many of the other dams are components of the Nelson River Power Project.

Source:

Canadian National Committee, International Commission on Large Dams, *Register of Dams in Canada*, 1982.

Appendix 6 Table 1
Mining Activity¹ by Ecozone, 1971, 1976 and 1981²

Ecozone	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Estab- lishments ⁴	Workers ⁵	Estab- lishments ⁴	Workers ⁵	Estab- lishments ⁴	Workers ⁵	Estab- lishments ⁴	Workers ⁵	Estab- lishments ⁴	Workers ⁵
Atlantic Maritime										
1971	5	1 772	7	3 159	46	1 312	23	262	81	6 505
1976	6	2 478	11	3 493	39	1 139	16	396	72	7 506
1981	8	2 550	14	3 500-3 999	45	1 240	20	348	87	7 500-7 999
Mixed-Wood Plain										
1971	6	1 211	0	0	31	6 373	202	2 994	239	10 578
1976	3	794	0	0	31	5 531	194	3 289	228	9 614
1981	0	0	0	0	31	5 578	154	2 180	185	7 758
Boreal Shield										
1971	82	37 269	0	0	13	1 010	29	336	124	38 615
1976	64	34 678	0	0	13	1 300	24	221	101	36 199
1981	67	32 799	0	0	15	1 011	22	178	104	33 988
Prairie										
1971	0	0	.. ⁶	.. ⁶	19	2 166	23	348	...	...
1976	0	0	8	390	19	2 880	14	281	41	3 551
1981	0	0	9	500-999	19	3 766	13	100-199	41	4 455
Boreal Plain										
1971	2	100-199	.. ⁶	.. ⁶	6	125	3	22	...	...
1976	3	560	3	717	7	160	1	1-99	14	1 000-1 499
1981	3	877	5	1 224	7	236	1	1-99	16	2 000-2 499
Montane Cordillera										
1971	19	3 256	.. ⁶	.. ⁶	4	60	4	52	...	...
1976	17	3 931	6	3 177	2	2-99	4	4-99	29	7 108
1981	21	5 414	5	3 500-3 999	2	2-99	2	2-99	30	9 243
Pacific Maritime										
1971	9	1 956	0	0	7	201	19	262	35	2 419
1976	8	1 376	0	0	4	133	11	155	23	1 664
1981	7	1 633	0	0	3	80	7	100-199	17	1 500-1 999
Boreal Cordillera										
1971	3	606	0	0	2	626	0	0	5	1 232
1976	4	641	0	0	1	500-999	0	0	5	1 000-1 499
1981	6	928	0	0	1	200-499	0	0	7	1 000-1 499
Tundra Cordillera										
1971	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1981	1	100-199	0	0	0	0	0	0	1	100-199
Taiga Plain										
1971	4	625	0	0	0	0	0	0	4	625
1976	1	500-999	0	0	0	0	0	0	1	500-999
1981	1	200-499	0	0	0	0	0	0	1	200-499
Taiga Shield										
1971	7	3 174	0	0	0	0	1	1-99	8	3 000-3 499
1976	12	4 661	0	0	1	200-499	1	1-99	14	4 500-4 999
1981	10	4 733	0	0	1	100-199	0	0	11	4 500-4 999
Northern Arctic										
1971	0	0	0	0	0	0	0	0	0	0
1976	1	1-99	0	0	0	0	0	0	1	1-99
1981	1	100-199	0	0	0	0	0	0	1	100-199
Canada										
1971	137	50 033	35	6 343	128	11 873	304	4 282	604	72 531
1976	118	49 834	28	7 777	116	12 035	265	4 412	527	74 058
1981	125	49 586	33	9 188	124	12 557	219	3 109	501	74 440

¹ Excludes crude petroleum and natural gas industry and services incidental to mining.

² Ranges are used to meet the confidentiality restrictions of the Statistics Act.

³ Includes asbestos, salt, potash, sulfur and miscellaneous non-metallic mineral mines.

⁴ The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

⁵ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

⁶ It was not possible to allocate the 1971 coal mining data by ecozone for Saskatchewan, Alberta and British Columbia. The unallocated figures are 28 establishments and 3 184 production workers. Coal mining is confined to Prairie, Boreal Plain and Montane Cordillera ecozones. These figures are included in the totals.

Sources:

Energy Mines and Resources Canada, Annual Census of Metal Mines, Non-Metal Mines and Sand Pits and Quarries, 1971, 1976 and 1981. Statistics Canada, Annual Census of Coal Mines, 1976 and 1981. Statistics Canada, *Coal Mines*, Catalogue 26-206, 1971. Statistics Canada, special tabulations by the Office of the Senior Adviser on Integration.

Appendix 6, Table 2
Mining Activity¹ by Drainage Basin, 1981²

Drainage Basin	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵
Atlantic Ocean Basin										
100.2-10 Churchill and Naskaupi Rivers	2	3 000-3 499	0	0	0	0	0	0	2	3 000-3 499
101 -10 Newfoundland, North Coast Rivers	2	200-499	0	0	1	200-499	0	0	3	883
103 -10 St. John's area Rivers	0	0	0	0	1	1-99	1	1-99	2	2-99
104 -12 Nova Scotia, Southeast Coast Rivers	0	0	0	0	0	0	4	94	4	94
110.1-24 Gulf, Mainland North Coast Rivers	3	742	0	0	0	0	2	2-99	5	500-999
110.2-24 Manicouagan and Outardes Rivers	2	1 500-1 999	0	0	0	0	0	0	2	1 500-1 599
110.3-24 Betsiamites River	0	0	0	0	1	1-99	0	0	1	1-99
111 -10 Gulf, Newfoundland West and South Coast Rivers	1	100-199	0	0	2	2-99	0	0	3	207
112 -24 North Gaspé Peninsula Rivers	1	1-99	0	0	10	73	0	0	11	100-199
113 Gulf, Mainland South and West Coast Rivers:	3	3 029	2	2-99	14	419	2	2-99	21	3 542
113 -12 Nova Scotia	0	0	2	2-99	1	100-199	0	0	3	200-499
113 -13 New Brunswick	2	1 500-1 999	0	0	13	259	1	1-99	16	2 117
113 -24 Québec	1	1 000-1 499	0	0	0	0	1	1-99	2	1 000-1 499
115 -12 Cape Breton Island Rivers	1	1-99	11	3 388	2	100-199	1	1-99	15	3 559
120 Bay of Fundy Coast Rivers:	2	100-199	0	0	5	345	4	109	11	500-999
120 -12 Nova Scotia	1	1-89	0	0	5	345	2	2-99	8	493
121 -13 New Brunswick	1	1-14	0	0	0	0	2	2-99	3	3-99
130 -13 Saint John River	0	0	1	200-499	0	0	5	86	6	200-499
140 -24 Saguenay River	1	100-199	0	0	2	2-99	6	57	9	215
141 -24 Québec City area - Middle North Shore Rivers	1	200-499	0	0	5	27	15	117	21	500-999
142 -24 Chaudière River - Middle South Shore Rivers	0	0	0	0	22	3 417	8	60	30	3 477
143 -24 St. Maurice River	0	0	0	0	0	0	4	14	4	14
144 -24 Eastern Townships Rivers - Richelieu River	0	0	0	0	4	1 459	24	205	28	1 664
145 -24 Eastern Laurentians Rivers	0	0	0	0	1	1-99	8	55	9	100-199
146 -24 Montréal area Rivers	0	0	0	0	3	36	21	439	24	475
147 West St. Lawrence River:	0	0	0	0	1	1-99	4	34	5	37
147 -24 Québec	0	0	0	0	1	1-99	2	2-99	3	17
147 -35 Ontario	0	0	0	0	0	0	2	2-99	2	2-99
150 Lower Ottawa River:	0	0	0	0	1	1-99	8	92	9	100-199
150 -24 Québec	0	0	0	0	1	1-99	3	16	4	4-99
150 -35 Ontario	0	0	0	0	0	0	5	76	5	76
151 Upper Ottawa River:	17	2 340	0	0	0	0	2	2-99	19	2 000-2 499
151 -24 Québec	9	901	0	0	0	0	2	2-99	11	500-999
151 -35 Ontario	8	1 439	0	0	0	0	0	0	8	1 439
160 -35 Belleville-Napanee area Rivers	0	0	0	0	1	1-99	1	1-99	2	2-99
161 -35 Trent River	0	0	0	0	2	100-199	4	37	6	200-499
162 -35 Oshawa-Colborne area Rivers	0	0	0	0	0	0	2	2-99	2	2-99
163 -35 Toronto area Rivers	0	0	0	0	0	0	19	282	19	282
164 -35 Hamilton area Rivers	0	0	0	0	0	0	12	381	12	381
165 -35 Niagara Peninsula Rivers	0	0	0	0	1	1-99	8	120	9	100-199
170 -35 Grand River	0	0	0	0	3	136	9	89	12	225
171 -35 Lake Erie Shore Rivers	0	0	0	0	2	200-499	1	1-99	3	326
172 -35 Thames River	0	0	0	0	0	0	5	153	5	153
173 -35 Sydenham River	0	0	0	0	0	0	2	2-99	2	2-99
180 -35 South Huron Shore Rivers	0	0	0	0	2	200-499	0	0	2	200-499

Appendix 6, Table 2
Mining Activity¹ by Drainage Basin, 1981² (continued)

Drainage Basin	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵
181 -35 Georgian Bay Shore - Lake Simcoe Shore Rivers	0	0	0	0	0	0	5	56	5	56
182 -35 North Huron Shore Rivers	6	12 775	0	0	2	100-199	6	69	14	12 500-12 999
190 -35 Lake Superior Shore Rivers	2	1 000-1 499	0	0	0	0	2	2-99	4	1 109
Hudson Bay and Ungava Bay Basin										
200.1-24 East Hudson Bay Coast Rivers	0	0	0	0	1	100-199	0	0	1	100-199
200.2-24 Ungava Bay Coast Rivers	1	1-99	0	0	0	0	0	0	1	1-99
200.3-24 Eastmain and LaGrande Rivers	4	1 416	0	0	0	0	0	0	4	1 416
210.1-24 Rupert and Nottaway Rivers	5	1 182	0	0	1	1-99	0	0	6	1 000-1 499
210.2-24 Harricanaw River	7	1 113	0	0	0	0	0	0	7	1 113
210.3-35 Moose River	3	3 116	0	0	1	1-99	0	0	4	3 000-3 499
210.5-35 Southwest Hudson Bay Coast Rivers	1	1-99	0	0	0	0	0	0	1	100-199
211.3 Churchill River:	3	1 233	0	0	0	0	0	0	3	1 233
211.3-46 Manitoba	1	500-999	0	0	0	0	0	0	1	500-999
211.3-47 Saskatchewan	2	500-999	0	0	0	0	0	0	2	500-999
220 -46 Nelson River	2	2 500-2 000	0	0	0	0	1	1-99	3	2 506
230 Lake Winnipeg Shore Rivers:	9	1 932	0	0	2	100-199	0	0	11	2 000-2 499
230 -35 Ontario	8	1 500-1 999	0	0	0	0	0	0	8	1 500-1 999
230 -46 Manitoba	1	1-99	0	0	2	100-199	0	0	3	269
231 -46 Red River	0	0	0	0	0	0	5	61	5	61
232 -46 Dauphin River	0	0	0	0	1	1-99	1	1-99	2	2-99
240 Assiniboine and Souris Rivers:	0	0	5	321	0	0	1	1-99	6	200-499
240 -46 Manitoba	0	0	0	0	0	0	1	1-99	1	1-99
240 -47 Saskatchewan	0	0	5	321	0	0	0	0	5	321
241 -47 Qu'Appelle River - Old Wives Lake	0	0	0	0	7	1 786	0	0	7	1 786
250 Saskatchewan River:	2	500-999	0	0	1	1-99	0	0	3	544
250 -46 Manitoba	1	200-499	0	0	0	0	0	0	1	200-499
250 -47 Saskatchewan	1	200-499	0	0	1	1-99	0	0	2	200-499
251 -48 Upper North Saskatchewan River	0	0	1	1-99	0	0	0	0	1	1-99
252 Lower North Saskatchewan River:	0	0	3	334	7	246	5	97	15	677
252 -47 Saskatchewan	0	0	0	0	3	110	0	0	3	110
252 -48 Alberta	0	0	3	334	4	136	5	97	12	567
253 South Saskatchewan River and Red Deer River:	0	0	2	2-99	6	1 807	2	2-99	10	1 922
253 -47 Saskatchewan	0	0	0	0	6	1 807	1	1-99	7	1 500-1 999
253 -48 Alberta	0	0	2	2-99	0	0	1	1-99	3	100-199
Arctic Ocean Basin										
300.1-61 Mackenzie River	2	100-199	0	0	0	0	0	0	2	100-199
300.2 Great Slave Lake Shore Rivers:	5	1 524	0	0	0	0	0	0	5	1 524
300.2-47 Saskatchewan	1	500-999	0	0	0	0	0	0	1	500-999
300.2-61 Northwest Territories	4	500-999	0	0	0	0	0	0	4	500-999
300.3 Liard River	4	212	0	0	1	200-499	0	0	5	500-999
300.3-59 British Columbia	3	3-99	0	0	1	200-499	0	0	4	553
300.3-61 Northwest Territories	1	100-199	0	0	0	0	0	0	1	100-199
301 -48 Athabasca River	0	0	3	914	2	2-99	0	0	5	500-999
302 -48 Peace River	0	0	1	500-999	1	1-99	0	0	2	500-999
330.2-61 Arctic Islands Rivers	1	100-199	0	0	0	0	0	0	1	100-199

Appendix 6, Table 2
Mining Activity¹ by Drainage Basin, 1981² (concluded)

Drainage Basin	Metal Mines		Coal Mines		Non-Metal Mines ³		Sand Pits and Quarries		Total	
	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵	Establish-ments ⁴	Workers ⁵
Pacific Ocean Basin										
400 -59 Columbia River	6	2 135	3	2 767	2	2-99	1	1-99	12	4 990
401 -59 Okanagan River	1	200-499	0	0	0	0	1	1-99	2	200-499
402 -59 Similkameen River	2	2-99	0	0	0	0	0	0	2	2-99
410 -59 Upper Fraser River	8	2 106	0	0	1	1-99	0	0	9	2 000-2 499
411 -59 Thompson River	2	200-499	0	0	0	0	0	0	2	200-499
412 -59 Lower Fraser River	0	0	0	0	2	2-99	3	63	5	100-199
420.1-60 Yukon River	3	838	0	0	0	0	0	0	3	838
431.1-59 Pacific Ocean, North Coast Rivers	3	416	0	0	0	0	0	0	3	416
431.2-59 Skeena River	2	200-499	0	0	0	0	0	0	2	200-499
431.3-59 Queen Charlotte Islands Rivers	1	100-199	0	0	0	0	0	0	1	100-199
432.1-59 Pacific Ocean, South Coast Rivers	1	1-99	0	0	0	0	3	80	4	100-199
432.2-59 Northern Vancouver Island Rivers	2	1 000-1 499	0	0	0	0	0	0	2	1 000-1 499
433 -59 Southern Vancouver Island Rivers	0	0	0	0	0	0	1	1-99	1	1-99
Gulf of Mexico Basin										
500 -47 Milk - Missouri Tributary Rivers	0	0	1	1-99	0	0	0	0	1	1-99
Canada	125	49 586	33	9 188	124	12 557	219	3 109	501	74 440

¹ Excludes crude petroleum and natural gas industry and services incidental to mining.

² Ranges are used to meet the confidentiality restrictions of the Statistics Act.

³ Includes asbestos, salt, potash, sulfur and miscellaneous non-metallic minerals mines.

⁴ The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

⁵ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

Source:

Energy, Mines and Resources Canada, Annual Census of Metal Mines, Non-Metal Mines and Sand Pits and Quarries, 1981.
 Statistics Canada, Annual Census of Coal Mines, 1981.
 Statistics Canada, special tabulation by the Office of the Senior Adviser on Integration.

Appendix 6, Table 3
Manufacturing Activity by Ecozone, 1973¹, 1976 and 1981²

Ecozone	High Stressor				Total			
	Establishments ³		Workers ⁴		Establishments ³		Workers ⁴	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Atlantic Maritime								
1973	43	2.3	14 336	22.5	1 898	100.0	63 847	100.0
1976	43	2.6	14 612	23.2	1 641	100.0	62 880	100.0
1981	38	1.9	14 408	21.5	2 048	100.0	66 987	100.0
Mixed-Wood Plain								
1973	190	0.9	66 830	7.1	20 553	100.0	935 914	100.0
1976	188	1.0	67 539	7.3	19 335	100.0	929 045	100.0
1981	207	0.9	70 458	7.4	23 508	100.0	947 246	100.0
Boreal Shield								
1973	61	3.8	39 418	52.7	1 620	100.0	74 841	100.0
1976	61	4.1	42 066	54.2	1 473	100.0	77 551	100.0
1981	61	3.3	43 295	49.5	1 835	100.0	87 403	100.0
Prairie								
1973	45	1.3	3 854	4.7	3 373	100.0	81 611	100.0
1976	43	1.3	3 961	4.3	3 227	100.0	91 967	100.0
1981	44	1.1	5 347	5.0	4 079	100.0	106 758	100.0
Boreal Plain								
1973	9	2.2	1 981	23.9	402	100.0	8 290	100.0
1976	10	3.0	2 694	29.9	338	100.0	9 003	100.0
1981	10	2.4	2 770	25.8	425	100.0	10 722	100.0
Montane Cordillera								
1973	17	2.5	5 548	19.3	693	100.0	28 681	100.0
1976	16	2.4	5 621	20.0	662	100.0	28 117	100.0
1981	17	1.9	6 711	20.8	905	100.0	32 234	100.0
Pacific Maritime								
1973	40	1.6	12 771	15.5	2 579	100.0	82 584	100.0
1976	40	1.7	13 228	17.0	2 346	100.0	77 815	100.0
1981	40	1.4	13 487	15.7	2 947	100.0	85 660	100.0
Boreal Cordillera								
1973	1	20.0	1-99	9.5	5	100.0	5-99	100.0
1976	1	20.0	1-99	9.5	5	100.0	5-99	100.0
1981	2	28.6	2-99	4.9	7	100.0	7-99	100.0
Taiga Plain								
1973	1	25.0	1-99	63.5	4	100.0	4-99	100.0
1976	1	16.7	1-99	44.3	6	100.0	6-99	100.0
1981	1	12.5	1-99	16.4	8	100.0	100-199	100.0
Taiga Shield								
1973	0	0.0	0	0.0	11	100.0	77	100.0
1976	0	0.0	0	0.0	10	100.0	92	100.0
1981	0	0.0	0	0.0	12	100.0	111	100.0
Hudson Bay Plain								
1973	0	0.0	0	0.0	2	100.0	2-99	100.0
1976	0	0.0	0	0.0	2	100.0	2-99	100.0
1981	0	0.0	0	0.0	1	100.0	1-99	100.0
Southern Arctic								
1973	0	0.0	0	0.0	5	100.0	44	100.0
1976	0	0.0	0	0.0	5	100.0	54	100.0
1981	0	0.0	0	0.0	2	100.0	2-99	100.0
Northern Arctic								
1973	0	...	0	...	0	100.0	0	100.0
1976	0	0.0	0	0.0	3	100.0	22	100.0
1981	0	0.0	0	0.0	3	100.0	27	100.0
Canada								
1973	407	1.3	144 780	11.3	31 145	100.0	1 275 985	100.0
1976	403	1.4	149 762	11.7	29 053	100.0	1 276 693	100.0
1981	420	1.2	156 499	11.7	35 780	100.0	1 337 329	100.0

¹ Census of Manufactures introduced the Standard Geographical Code in 1973; earlier data could not be readily allocated to ecozones.

² Ranges are used in order to meet the confidentiality restrictions of the Statistics Act.

³ The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

⁴ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

Source:

Statistics Canada, Annual Census of Manufactures, 1973, 1976 and 1981, special tabulations by the Office of the Senior Adviser on Integration.

Appendix 6, Table 4

Manufacturing Activity by Stressor Type: Stress to Water, by Drainage Basin¹, 1981

Drainage Basin		High Stressor			Medium Stressor			Low Stressor			Total		
		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³	
			Number	Percent of Total		Number	Percent of Total		Number	Percent of Total			
Atlantic Ocean Basin													
100.2-10	Churchill and Naskaupi Rivers	0	0	0	1	1-99	60.0	3	3-99	40.0	4	4-99	
101 -10	Newfoundland, North Coast Rivers	1	500-999	38.4	26	1 500- 1 999	50.4	39	200-499	11.2	66	2 500- 2 999	
102 -10	Trinity Bay Coast Rivers	0	0	0	28	2 008	89.1	31	245	10.9	59	2 253	
103 -10	St. John's area Rivers	2	2-99	2.8	51	1 500- 1 999	60.7	53	1 000- 1 499	36.4	106	3 000- 3 499	
104 -12	Nova Scotia, Southeast Coast Rivers	5	1 066	9.0	137	6 197	52.4	252	4 567	38.6	394	11 830	
110.1-24	Gulf, Mainland North Coast Rivers	2	2 000- 2 499	85.2	17	200-499	10.0	22	100-199	4.8	41	2 500- 2 999	
110.2-24	Manicouagan and Outardes Rivers	0	0	0	6	19	6.9	9	257	93.1	15	276	
110.3-24	Betsiamites Rivers	0	0	0	2	2-99	22.5	5	5-99	77.5	7	7-99	
111 -10	Gulf, Newfoundland West and South Coast Rivers	3	1 869	26.1	41	4 662	65.0	37	636	8.9	81	7 167	
112 -24	North Gaspé Peninsula Rivers	1	100-199	6.1	37	500-999	36.6	113	1 000- 1 499	57.4	151	1 500- 1 999	
113	Gulf, Mainland South and West Coast Rivers:	14	4 800	29.1	143	6 352	38.5	230	5 352	32.4	387	16 504	
113 -12	Nova Scotia	2	500-999	10.9	20	2 000- 2 499	47.5	49	2 000- 2 499	41.7	71	5 000- 5 499	
113 -13	New Brunswick	9	3 067	38.1	79	2 563	31.8	123	2 423	30.1	211	8 053	
113 -24	Québec	3	1 000- 1 499	35.7	44	1 000- 1 499	40.7	58	500-999	23.7	105	3 000- 3 499	
114 -11	Prince Edward Island Rivers	0	0	0	70	1 841	77.3	80	541	22.7	150	2 382	
115 -12	Cape Breton Island Rivers	5	2 724	55.9	35	1 653	33.9	58	499	10.2	98	4 876	
120	Bay of Fundy Coast Rivers:	3	439	4.1	146	4 788	44.3	241	0	51.7	390	10 811	
120 -12	Nova Scotia	1	100-199	2.2	94	3 000- 3 499	45.8	156	3 000- 3 499	52.0	251	6 500- 6 999	
121 -13	New Brunswick	2	200-299	7.1	52	1 500- 1 999	41.9	85	2 000- 2 499	51.0	139	4 000- 4 499	
130	Saint John River:	7	2 549	18.0	86	3 562	25.2	252	8 052	56.9	345	14 163	
130 -13	New Brunswick	6	2 000- 2 499	19.9	76	3 500- 3 999	28.5	194	6 000- 6 499	51.5	276	12 000- 12 499	
130 -24	Québec	1	100-199	5.5	10	10-99	3.3	58	1 500- 1 999	91.2	69	1 500- 1 999	
140 -24	Saguenay River	10	8 930	64.4	67	1 510	10.9	182	3 422	24.7	259	13 862	
141 -24	Québec City area — Middle North Shore Rivers	8	3 837	21.9	155	4 461	25.4	486	9 253	52.7	649	17 551	
142 -24	Chaudière River — Middle South Shore Rivers	5	748	3.1	222	5 333	22.2	607	17 896	74.6	834	23 977	
143 -24	St. Maurice River	9	7 268	48.1	70	3 621	24.0	161	4 221	27.9	240	15 110	
144 -24	Eastern Townships Rivers — Richelieu River	24	6 195	9.0	536	22 614	32.8	1 219	40 194	58.2	1 779	69 003	
145 -24	Eastern Laurentians Rivers	4	1 006	9.8	100	3 289	32.1	298	5 944	58.1	402	10 239	
146 -24	Montreal area Rivers	41	6 882	3.4	1 333	49 307	24.6	4 379	144 546	72.0	5 753	200 735	
147	West St. Lawrence River:	17	2 976	13.4	148	11 397	51.2	200	7 885	35.4	365	22 258	
147 -24	Québec	6	1 223	22.3	35	3 717	67.8	35	539	9.8	76	5 479	
147 -35	Ontario	11	1 753	10.4	113	7 680	45.8	165	7 346	43.8	289	16 779	
150	Lower Ottawa River:	14	5 251	20.3	232	5 776	22.3	613	14 895	57.5	859	25 922	
150 -24	Québec	9	4 099	31.8	90	2 298	17.8	277	6 494	50.4	376	12 891	
150 -35	Ontario	5	1 152	8.8	142	3 478	26.7	336	8 401	64.5	483	13 031	

Appendix 6, Table 4

Manufacturing Activity by Stressor Type: Stress to Water, by Drainage Basin¹, 1981 (continued)

Drainage Basin		High Stressor			Medium Stressor			Low Stressor			Total	
		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³
			Number	Percent of Total		Number	Percent of Total		Number	Percent of Total		
151	Upper Ottawa River:	5	1 915	15.0	76	2 302	18.0	228	8 537	66.9	309	12 754
151 -24	Québec	3	1 500- 1 999	47.2	13	100-199	5.1	40	1 500- 1 999	47.7	56	3 000- 3 499
151 -35	Ontario	2	200-499	4.3	63	2 000- 2 499	22.4	188	7 000- 7 499	73.3	253	9 500- 9 999
160 -35	Belleville-Napanee area Rivers	2	200-499	2.9	67	2 500- 2 999	42.2	102	3 599- 3 999	54.9	171	7 000- 7 499
161 -35	Trent River	2	200-499	2.6	101	2 000- 2 499	17.1	207	10 000- 10 499	80.2	310	12 500- 12 999
162 -35	Oshawa-Colborne area Rivers	2	500-999	2.8	62	1 500- 1 999	10.3	124	16 000- 16 499	86.9	188	18 500- 18 999
163 -35	Toronto area Rivers	23	2 724	1.1	2 022	65 936	26.7	4 871	178 639	72.2	6 916	247 299
164 -35	Hamilton area Rivers	15	20 747	33.6	367	15 194	24.6	578	25 797	41.8	960	61 738
165 -35	Niagara Peninsula Rivers	15	5 429	15.0	275	11 075	30.6	339	19 692	54.4	629	36 196
170 -35	Grand River	7	531	0.8	492	23 212	35.8	766	41 055	63.4	1 265	64 798
171 -35	Lake Erie Shore Rivers	3	1 500- 1 999	3.8	318	11 500- 11 999	29.5	430	27 000- 27 499	66.7	751	40 000- 40 499
172 -35	Thames River	1	1-99	--	276	9 500- 9 999	29.2	448	23 500- 23 999	70.8	725	33 500- 33 999
173 -35	Sydenham River	16	5 653	42.9	97	3 509	26.6	95	4 028	30.5	208	13 190
180 -35	South Huron Shore Rivers	1	200-499	3.8	129	2 500- 2 999	22.9	231	8 000- 8 499	73.3	361	11 000- 11 499
181 -35	Georgian Bay Shore — Lake Simcoe Shore Rivers	3	500-999	2.8	162	7 000- 7 499	38.9	363	11 000- 11 499	58.4	528	18 500- 18 999
182 -35	North Huron Shore Rivers	13	14 837	76.2	84	1 735	8.9	167	2 906	14.9	264	19 478
190 -35	Lake Superior Shore Rivers	9	5 105	57.7	28	337	3.8	88	3 401	38.5	125	8 843
Hudson Bay and Ungava Bay Basin												
200.3-24	Eastmain and LaGrande Rivers	0	0	0	1	1-99	100.0	0	0	0	1	1-99
210.1-24	Rupert and Nottaway Rivers	1	200-499	20.2	4	4-99	1.6	20	1 500- 1 999	78.2	25	2 000- 2 499
210.2-24	Harricanaw River	0	0	0	11	129	9.3	33	1 263	90.7	44	1 392
210.3	Moose River:	6	3 500- 3 999	54.2	23	100-199	2.6	63	2 500- 2 999	43.2	92	6 500- 6 999
210.3-24	Québec	0	0	0	10	66	5.4	23	1 161	94.6	33	1 227
210.3-35	Ontario	6	3 500- 3 999	66.3	13	100-199	2.0	40	1 500- 1 999	31.7	59	5 000- 5 499
210.4-35	Albany River	0	0	0	0	0	0	6	404	100	6	404
211.1-61	West Hudson Bay Coast Rivers	0	0	0	1	1-99	100.0	0	0	0	1	1-99
211.3	Churchill River:	0	0	0	11	78	22.4	23	270	77.6	34	348
211.3-46	Manitoba	0	0	0	1	1-99	33.3	2	2-99	66.7	3	3-99
211.3-47	Saskatchewan	0	0	0	5	5-99	12.9	6	100-199	87.1	11	200-499
211.3-48	Alberta	0	0	0	5	47	38.5	15	75	61.5	20	122
220 -46	Nelson River	1	500-999	88.7	3	3-99	3.8	5	5-99	7.5	9	500-999
230	Lake Winnipeg Shore Rivers:	5	2 500- 2 999	70.8	20	200-499	5.7	72	500-999	23.5	97	4 000- 4 999
230 -35	Ontario	4	2 500- 2 999	74.0	9	9-99	2.0	49	500-999	24.0	62	3 000- 3 499
230 -46	Manitoba	1	200-499	55.4	11	100-199	23.4	23	100-199	21.2	35	500-999
231 -46	Red River	8	935	2.5	307	9 652	26.0	732	26 496	71.5	1 047	37 083
232	Dauphin River:	1	200-499	16.2	25	200-499	28.2	41	500-999	55.6	67	1 500- 1 999
232 -46	Manitoba	1	200-499	27.0	22	200-499	45.2	36	200-499	27.8	59	500-999
232 -47	Saskatchewan	0	0	0	3	16	2.6	5	604	97.4	8	620

Appendix 6, Table 4

Manufacturing Activity by Stressor Type: Stress to Water, by Drainage Basin¹, 1981 (continued)

Drainage Basin		High Stressor			Medium Stressor			Low Stressor			Total	
		Establish-ments ²	Workers ³		Establish-ments ²	Workers ³		Establish-ments ²	Workers ³		Establish-ments ²	Workers ³
			Number	Percent of Total		Number	Percent of Total		Number	Percent of Total		
240	Assiniboine and Souris Rivers:	2	100-199	2.6	92	1 500-1 999	45.5	143	2 000-2 499	51.9	237	3 500-3 999
240 -46	Manitoba	2	100-199	4.7	46	1 000-1 499	55.6	74	500-999	39.8	122	2 000-2 499
240 -47	Saskatchewan	0	0	0	46	544	32.3	69	1 142	67.7	115	1 686
241 -47	Qu'Appelle River — Old Wives Lake:	4	200-499	3.9	88	2 500-2 999	53.2	169	2 000-2 499	42.8	261	5 000-5 499
250	Saskatchewan River:	2	500-999	41.2	22	100-199	13.1	38	500-999	45.8	62	1 000-1 499
250 -46	Manitoba	1	200-499	61.7	1	1-99	1.7	11	200-499	36.6	13	500-999
250 -47	Saskatchewan	1	200-499	26.1	21	100-199	21.4	27	200-499	52.5	49	500-999
251 -48	Upper North Saskatchewan River	0	0	0	24	320	46.7	24	365	53.3	48	685
252	Lower North Saskatchewan River:	20	3 935	13.6	360	11 120	38.5	725	13 802	47.8	1 105	28 857
252 -47	Saskatchewan	1	200-499	27.9	22	200-499	23.6	59	500-999	48.4	82	1 000-1 499
252 -48	Alberta	19	3 500-3 999	12.9	338	10 500-10 999	39.3	666	13 00-13 499	47.8	1 023	27 000-27 499
253	South Saskatchewan River and Red Deer River:	9	794	6.0	233	5 917	44.6	357	6 554	49.4	599	13 265
253 -47	Saskatchewan	3	78	1.5	83	2 324	45.6	149	2 690	52.8	235	5 092
253 -48	Alberta	6	716	8.8	150	3 593	44.0	208	3 864	47.3	364	8 173
254 -48	Bow River	7	930	4.6	259	7 871	38.7	582	11 556	56.8	848	20 357
Arctic Ocean Basin												
300.1-61	Mackenzie River	1	1-99	29.2	0	0	0	2	2-99	70.8	3	3-99
300.2	Great Slave Lake Shore Rivers:	0	0	0	3	26	21.3	10	96	78.7	13	122
300.2-47	Saskatchewan	0	0	0	0	0	0	1	1-99	100.0	1	1-99
300.2-61	Northwest Territories	0	0	0	3	26	21.3	9	9-99	78.7	12	100-199
300.3	Liard River:	0	0	0	2	2-99	6.8	3	100-199	93.2	5	100-199
300.3-59	British Columbia	0	0	0	2	2-99	9.4	1	100-199	90.6	3	100-199
300.3-60	Yukon	0	0	0	0	0	0	2	2-99	100.0	2	2-99
301 -48	Athabasca River	0	0	0	26	255	15.5	59	1 389	84.5	85	1 644
302	Peace River:	3	500-999	21.5	36	200-499	11.4	68	2 000-2 499	67.2	107	3 500-3 999
302 -48	Alberta	1	200-499	22.3	25	200-499	16.4	35	1 000-1 499	61.3	61	1 500-1 999
302 -59	British Columbia	2	200-499	20.5	11	100-199	5.8	33	1 000-1 499	73.7	46	1 500-1 999
330.1-61	Mainland Arctic Coast Rivers	0	0	0	0	0	0	1	1-99	100	1	1-99
330.2-61	Arctic Islands Rivers	0	0	0	1	1-99	44.4	2	2-99	55.6	3	3-99
Pacific Ocean Basin												
400 -59	Columbia River	5	4 131	48.8	33	430	5.1	132	3 898	46.1	170	8 459
401 -59	Okanagan River	0	0	0	84	1 000-1 499	26.1	206	3 500-3 999	73.9	290	5 000-5 499
402 -59	Similkameen River	0	0	0	2	2-99	6.7	10	10-99	93.3	12	12-99
410 -59	Upper Fraser River	8	1 746	13.3	56	922	7.0	199	10 461	79.7	263	13 129
411 -59	Thompson River	3	624	12.7	46	413	8.4	131	3 894	79.0	180	4 931
412 -59	Lower Fraser River	18	1 816	3.5	541	15 645	29.9	1 434	34 881	66.6	1 993	52 342
420.1-60	Yukon River	2	2-99	5.3	1	1-99	10.5	3	3-99	84.2	6	6-99
431.1-59	Pacific Ocean, North Coast Rivers	3	2 000-2 499	85.5	6	100-199	6.5	5	200-499	8.1	14	2 500-2 999
431.2-59	Skeena River	1	500-999	19.5	20	1 000-1 499	43.0	41	1 000-1 499	37.6	62	3 000-3 499
431.3-59	Queen Charlotte Islands Rivers	0	0	0	1	1-99	68.2	2	2-99	31.8	3	3-99
432.1-59	Pacific Ocean, South Coast Rivers	10	3 274	32.9	85	1 801	18.1	247	4 878	49.0	342	9 953

Appendix 6, Table 4

Manufacturing Activity by Stressor Type: Stress to Water, by Drainage Basin¹, 1981 (concluded)

Drainage Basin	High Stressor			Medium Stressor			Low Stressor			Total	
	Establish- ments ²	Workers ³		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³		Establish- ments ²	Workers ³
		Number	Percent of Total		Number	Percent of Total		Number	Percent of Total		
432.2-59 Northern Vancouver Island Rivers	6	4 000- 4 499	51.0	40	200-499	5.6	144	3 500- 3 999	43.4	190	8 500- 8 999
433 -59 Southern Vancouver Island Rivers	2	500-999	11.7	73	1 000- 1 499	17.1	231	5 500- 5 999	71.1	306	7 500- 7 999
Gulf of Mexico Basin											
500 Milk - Missouri	0	0	0	1	1-99	0.7	4	100-199	99.3	5	100-199
500 -47 Tributary Rivers	0	0	0	1	1-99	1.3	1	1-99	98.7	2	2-99
500 -48 Saskatchewan	0	0	0	0	0	0	3	60	100.0	3	60
Canada	420	156 499	11.7	10 786	370 208	27.7	24 574	810 622	60.6	35 780	1 337 329

¹ Ranges are used in order to meet the confidentiality restrictions of the Statistics Act.

² The establishment is defined as the smallest operating unit capable of reporting a specified range of basic industrial statistics.

³ Includes production and related workers, e.g. those at the establishment engaged in processing, assembling and other activities such as storing, inspecting and handling.

Source:

Statistics Canada, Annual Census of Manufactures, 1981, special tabulation by the Office of the Senior Adviser on Integration.

Appendix 6, Table 5

Manufacturing Water Use by Industry Group, 1976¹

Industry Group	Number of Plants	Total Water Intake ²	Recirculated ³	Gross Water Use ⁴	Consumption ⁵	Total Water Discharge ⁶	Use Rate ⁷	Consumption Rate ⁸
		millions of cubic metres						percent
Paper and Allied	461	3 132	5 736	8 868	170	2 962	2.8	5.4
Primary Metal	238	2 094	1 977	4 071	77	2 018	1.9	3.7
Chemical and Chemical Products	656	1 463	1 548	3 010	104	1 359	2.1	7.1
Petroleum and Coal Products	85	616	1 017	1 633	35	581	2.7	5.7
Transportation Equipment	476	376	427	803	1	374	2.1	0.3
Food and Beverage	2 123	359	162	521	31	328	1.5	8.6
Wood	1 079	331	158	489	8	323	1.5	2.4
Textile	414	139	104	242	7	131	1.7	5.0
Non-Metallic Mineral Products	641	95	152	247	16	79	2.6	16.8
Rubber and Plastic	359	60	81	140	6	54	2.3	10.0
Total	6 532	8 664	11 360	20 024	456	8 207	2.3	5.3

¹ Data obtained from the 1976 Water Use Survey. Only the larger establishments (i.e. those receiving the long form questionnaires during the 1976 Census of Manufactures) and the ten major SIC industrial groups identified as the largest users of water in manufacturing were covered by this survey.

² Total amount of water added to the water system of the plant to replace water discharged or consumed during production.

³ Water used at least twice in the manufacturing process.

⁴ New water intake plus recycled water.

⁵ Water which is lost in the production process.

⁶ Water returned to the environment.

⁷ The ratio of gross water use to water intake; represents an index of recirculation.

⁸ Proportion of the water lost during production, most commonly through evaporation or incorporation of water into products.

Source:

Environment Canada, Water Use in Manufacturing Industries 1976 Survey, special tabulation by the Office of the Senior Adviser on Integration, Statistics Canada.

Note:

Individual items may not add to totals due to rounding.

Appendix 6, Table 6

Population Served by Municipal Wastewater Treatment System by Drainage Basin¹

Drainage Basin	Municipal Population Served by Wastewater Treatment Systems				Municipal Population ⁶	Percent of Municipal Population Served
	Primary ²	Sec-on-dary ³	Lagoons ⁴	Other ⁵			Total
percent						
Atlantic Ocean Basin						
100.1-10 Labrador Coast Rivers	0	0	0	0	3 994	0
100.2-10 Churchill and Naskaupi Rivers	0	17 600	0	0	17 600	61.5
101 -10 Newfoundland, North Coast Rivers	1 200	15 010	0	1 245	17 455	15.3
102 -10 Trinity Bay Coast Rivers	0	4 690	1 200	490	6 380	12.7
103 -10 St. John's area Rivers	0	1 931	0	0	1 931	1.3
104 -12 Nova Scotia, Southeast Coast Rivers	0	27 465	0	3 121	30 586	10.4
110.1 Gulf, Mainland North Coast Rivers:	0	6 200	0	11 500	17 700	23.2
110.1-10 Labrador	0	0	0	0	0	0
110.1-24 Québec	0	6 200	0	11 500	17 700	23.8
110.2-24 Manicouagan and Outardes Rivers	0	8 600	0	0	8 600	34.7
110.3-24 Betsiamites Rivers	0	0	1 530	0	1 530	11.7
111 -10 Gulf, Newfoundland West and South Coast Rivers	0	6 632	0	5 282	11 914	7.7
112 -24 North Gaspé Peninsula Rivers	35	6 372	5 300	1 875	13 582	9.9
113 Gulf, Mainland South and West Coast Rivers:	0	88 600	49 797	160	138 557	58.8
113 -12 Nova Scotia	0	25 943	5 442	0	31 385	85.8
113 -13 New Brunswick	0	41 750	43 675	0	85 425	90.5
113 -24 Québec	0	20 907	680	160	21 747	20.8
114 -11 Prince Edward Island Rivers	37 439	1 878	13 452	0	52 769	92.8
115 -12 Cape Breton Island Rivers	0	15 445	1 757	820	18 022	14.9
120 Bay of Fundy Coast Rivers:	0	39 340	22 293	0	61 633	33.6
120 -12 Nova Scotia	0	35 740	11 962	0	47 702	55.4
121 -13 New Brunswick	0	3 600	10 331	0	13 931	14.3
130 Saint John River:	0	95 526	50 530	6 564	152 620	60.6
130 -13 New Brunswick	0	94 926	44 295	3 364	142 585	67.7
130 -24 Québec	0	600	6 235	3 200	10 035	24.4
140 -24 Saguenay River	0	4 068	2 990	1 500	8 558	3.0
141 -24 Québec City area - Middle North Shore Rivers	0	7 950	600	0	8 550	1.3
142 -24 Chaudière River - Middle South Shore Rivers	9 200	14 015	16 765	3 755	43 735	11.1
143 -24 St. Maurice River	0	1 100	0	0	1 100	0.6
144 -24 Eastern Township Rivers - Richelieu River	4 150	26 598	13 020	180	43 948	5.2
145 -24 Eastern Laurentian Rivers	0	11 973	850	200	13 023	6.0
146 -24 Montréal area Rivers	41 452	118 092	0	3 375	162 919	5.5
147 West St. Lawrence River:	144 376	3 825	12 365	4 569	165 135	68.2
147 -24 Québec	0	2 525	0	0	2 525	3.5
147 -35 Ontario	144 376	1 300	12 365	4 569	162 610	96.2
150 Lower, Ottawa River:	396 229	23 389	19 254	5 442	444 314	53.7
150 -24 Québec	0	11 585	2 025	1 890	15 500	4.4
150 -35 Ontario	396 229	11 804	17 229	3 552	428 814	90.4
151 Upper Ottawa River:	37 606	59 437	29 084	5 000	131 127	45.1
151 -24 Québec	4 000	2 100	12 340	0	18 440	20.5
151 -35 Ontario	33 606	57 337	16 744	5 000	112 687	56.2
160 -35 Belleville-Napanee area Rivers	5 300	55 843	6 158	172	67 473	68.7
161 -35 Trent River	14 600	79 735	22 856	0	117 191	77.5
162 -35 Oshawa-Colborne area Rivers	0	182 547	1 300	750	184 597	79.4
163 -35 Toronto area Rivers	0	2 602 050	0	0	2 602 050	94.6
164 -35 Hamilton area Rivers	0	572 697	32 628	0	605 325	93.5
165 -35 Niagara Peninsula Rivers	133 841	157 964	6 996	0	298 801	80.0
170 -35 Grand River	0	385 723	15 348	4 810	405 881	82.3
171 -35 Lake Erie Shore Rivers	166 260	191 997	39 102	4 952	402 311	85.2
172 -35 Thames River	0	350 291	15 942	2 500	368 733	82.8
173 -35 Sydenham River	62 417	21 924	12 405	750	97 496	68.0
180 -35 South Huron Shore Rivers	19 697	42 437	32 951	1 320	96 405	70.7
181 -35 Georgian Bay Shore - Lake Simcoe Shore Rivers	27 226	119 921	19 673	0	166 820	64.0
182 -35 North Huron Shore Rivers	76 500	176 754	21 540	0	274 794	80.0
190 -35 Lake Superior Shore Rivers	59 294	0	4 420	1 566	65 280	49.4
Hudson Bay and Ungava Bay Basin						
200.2-24 Ungava Bay Coast Rivers	0	4 300	0	0	4 300	100.0
210.1-24 Rupert and Nottaway Rivers	0	4 800	0	0	4 800	15.0
210.2-24 Harricaniaw River	0	0	1 500	0	1 500	3.2
210.3 Moose River:	28 204	17 492	10 367	3 525	59 588	54.5
210.3-24 Québec	140	0	1 100	0	1 240	5.4
210.3-35 Ontario	28 064	17 492	9 267	3 525	58 348	67.7
210.4-35 Albany River	0	6 657	0	0	6 657	85.4
211.1-61 West Hudson Bay Coast Rivers	0	0	3 063	169	3 232	84.3
211.3 Churchill River:	0	4 450	14 111	0	18 561	84.8
211.3-46 Manitoba	0	4 450	2 700	0	7 150	99.3
211.3-47 Saskatchewan	0	0	5 326	0	5 326	93.8
211.3-48 Alberta	0	0	6 085	0	6 085	67.6
220 -46 Nelson River	14 000	2 675	7 508	1 300	25 483	98.3

Appendix 6, Table 6

Population Served by Municipal Wastewater Treatment System by Drainage Basin¹ (continued)

Drainage Basin		Municipal Population Served by Wastewater Treatment Systems				Municipal Population ⁶	Percent of Municipal Population Served
		Primary ²	Secondary ³	Lagoons ⁴	Other ⁵			Total
							percent
230	Lake Winnipeg Shore Rivers:	9 000	24 513	9 756	0	43 269	70.5
230 -35	Ontario	9 000	23 402	700	0	33 102	74.8
230 -46	Manitoba	0	1 111	9 056	0	10 167	59.4
231 -46	Red River	0	587 689	44 267	0	631 956	98.2
232	Dauphin River:	0	0	33 678	0	33 678	82.4
232 -46	Manitoba	0	0	27 522	0	27 522	80.0
232 -47	Saskatchewan	0	0	6 156	0	6 156	95.5
240	Assiniboine and Souris Rivers:	0	68 159	79 974	0	148 133	95.5
240 -46	Manitoba	0	52 659	24 423	0	77 082	93.4
240 -47	Saskatchewan	0	15 500	55 551	0	71 051	97.9
241 -47	Qu'Appelle River-Old Wives Lake	0	0	217 147	0	217 147	99.1
250	Saskatchewan River:	13 742	0	19 810	0	33 552	92.9
250 -46	Manitoba	9 500	0	8 000	0	17 500	88.6
250 -47	Saskatchewan	4 242	0	11 810	0	16 052	98.2
251 -48	Upper North Saskatchewan River	0	12 628	37 971	0	50 599	99.8
252	Lower North Saskatchewan River:	30 500	532 093	124 251	3 937	690 781	84.2
252 -47	Saskatchewan	30 500	16 255	35 382	0	82 137	97.9
252 -48	Alberta	0	515 838	88 869	3 937	608 644	82.6
253	South Saskatchewan River and Red Deer River:	135 900	65 310	169 386	0	370 596	95.6
253 -47	Saskatchewan	135 900	0	36 672	0	172 572	99.5
253 -48	Alberta	0	65 310	132 714	0	198 024	92.4
254 -48	Bow River	100 000	414 060	16 558	0	530 618	98.9
Arctic Ocean Basin							
300.1-61	Mackenzie River	0	0	4 033	384	4 417	57.2
300.2	Great Slave Lake Shore Rivers	0	0	15 923	1 640	17 563	92.0
300.2-48	Alberta	0	0	0	0	0	0
300.2-61	Northwest Territories	0	0	15 923	1 640	17 563	97.7
300.3	Liard River	0	0	4 200	0	4 200	95.3
300.3-59	British Columbia	0	0	3 600	0	3 600	100.0
300.3-60	Yukon	0	0	600	0	600	74.2
301 -48	Athabasca River	0	4 056	57 263	3 091	64 410	100.0
302	Peace River:	0	200	72 919	0	73 119	93.3
302 -48	Alberta	0	200	41 654	0	41 854	89.1
302 -59	British Columbia	0	0	31 265	0	31 265	99.7
330.1-61	Mainland Arctic Coast Rivers	0	0	762	0	762	100.0
330.2-61	Arctic Islands Rivers	0	0	594	0	594	12.5
Pacific Ocean Basin							
400 -59	Columbia River	29 435	21 798	38 250	0	89 483	92.8
401 -59	Okanagan River	0	70 075	4 300	0	74 375	60.3
402 -59	Similkameen River	0	0	3 100	0	3 100	81.6
410 -59	Upper Fraser River	1 550	86 800	20 600	2 073	111 023	100.0
411 -59	Thompson River	0	64 107	2 450	0	66 557	74.7
412 -59	Lower Fraser River	0	27 370	7 000	13 500	47 870	4.9
420.1-60	Yukon River	0	160	17 150	800	18 110	87.8
430 -60	Alsek River	0	0	350	0	350	77.8
431.1-59	Pacific Ocean, North Coast Rivers	0	1 200	13 000	0	14 200	98.6
431.2-59	Skeena River	10 000	6 830	2 600	0	19 430	48.1
431.3-59	Queen Charlotte Islands Rivers	0	0	0	0	0	0
432.1-59	Pacific Ocean, South Coast Rivers	130 000	22 453	1 241	0	153 694	89.4
432.2-59	Northern Vancouver Island Rivers	32 000	21 650	29 355	9 900	92 905	79.7
433 -59	Southern Vancouver Island Rivers	3 600	10 500	11 700	192 436	218 236	99.6
Gulf of Mexico Basin							
500	Milk - Missouri Tributary Rivers:	0	0	3 216	0	3 216	98.0
500 -47	Saskatchewan	0	0	2 402	0	2 402	97.4
500 -48	Alberta	0	0	814	0	814	100.0
Canada		1 774 753	7 627 644	1 571 459	304 653	11 278 509	54.0

¹ Data obtained from MUNDAT (a national inventory of waterworks and wastewater systems in Canada). The updating of the information occurs on a continuous basis, as received from participating agencies. The data presented here are current as of May 1984. The extent to which the information is obtained and its completeness is not uniform for all of Canada.

² Primary systems are those which depend on physical or mechanical unit operations (e.g. bar screen, grit removal, sedimentation tank) as the sole component for removing solids.

³ Secondary systems include mechanical plants having aerobic biological treatment processes (use of naturally occurring bacteria in sewage) and secondary clarifiers.

⁴ Lagoons are man-made pools where natural waste decomposition occurs through contact with the air and naturally occurring micro-organisms, and through the settling of solids.

⁵ Other types of treatment systems which are not specified (e.g. comminution only, grit removal only).

Appendix 6, Table 6

Population Served by Municipal Wastewater Treatment System by Drainage Basin¹ (concluded)

* Current municipal population as reported to MUNDAT. This represents about eighty-six percent of the total population of Canada (1981 Census). Much of the remaining population lives in rural areas and for the most part is serviced by private waste treatment and disposal systems such as septic tanks and tile fields. Population in certain drainage basins may appear to be inconsistent with 1981 Census figures. These discrepancies may be the result of errors such as the following: non-inclusion or double counting of

populated areas, variations in respondents' interpretation of the survey questions, variations in the completeness and correctness of information available to respondents, processing of data.

Source:

Environment Canada, Environmental Protection Service, MUNDAT Data Base, special tabulation.

Appendix 6, Table 7

Estimated Daily Waste Discharged from Municipalities by Drainage Basin¹

Drainage Basin	Waste Generated ²			Waste Removed ³			Waste Discharged			
	BOD ₅	Suspended Solids	Phos-phorus	BOD ₅	Suspended Solids	Phos-phorus	BOD ₅	Suspended Solids	Phos-phorus	
	kilograms per day			percent			kilograms per day			
Atlantic Ocean Basin										
100.1-10	Labrador Coast Rivers	549	494	17	0	0	0	549	494	17
100.2-10	Churchill and Naskaupi Rivers	3 990	3 590	127	49.7	55.9	22.8	2 007	1 583	98
101 -10	Newfoundland, North Coast Rivers	22 344	20 110	715	17.5	27.5	7.0	18 437	14 587	665
102 -10	Trinity Bay Coast Rivers	6 399	5 759	204	4.7	5.3	2.9	6 096	5 452	198
103 -10	St. John's area Rivers	21 017	18 915	672	0.9	1.0	0.9	20 826	18 721	666
104 -12	Nova Scotia, Southeast Coast Rivers	38 667	34 800	1 237	4.4	5.0	2.3	36 961	33 074	1 209
110.1	Gulf, Mainland North Coast Rivers:	8 921	8 029	284	5.5	6.2	2.8	8 430	7 532	276
110.1-10	Labrador	244	220	7	0	0	0	244	220	7
110.1-24	Québec	8 677	7 809	277	5.7	6.4	2.9	8 186	7 312	269
110.2-24	Manicouagan and Outardes Rivers	2 586	2 327	82	11.1	12.5	6.1	2 298	2 035	77
110.3-24	Betsiamites Rivers	2 011	1 809	64	5.1	4.3	3.1	1 908	1 732	62
111 -10	Gulf, Newfoundland West and South Coast Rivers	21 087	18 978	674	2.9	3.2	1.8	20 485	18 370	662
112 -24	North Gaspé Peninsula Rivers	17 900	16 110	572	2.7	2.8	1.7	17 409	15 654	562
113	Gulf, Mainland South and West Coast Rivers:	28 085	25 278	897	42.3	44.5	19.3	16 193	14 023	724
113 -12	Nova Scotia	5 326	4 794	170	64.3	72.3	30.0	1 903	1 329	119
113 -13	New Brunswick	8 903	8 014	284	73.2	72.8	30.6	2 385	2 180	197
113 -24	Québec	13 856	12 470	443	14.1	15.7	7.9	11 905	10 514	408
114 -11	Prince Edward Island Rivers	6 719	6 047	215	36.0	58.7	15.3	4 297	2 499	182
115 -12	Cape Breton Island Rivers	14 666	13 199	469	3.0	3.4	1.7	14 226	12 754	461
120	Bay of Fundy Coast Rivers:	20 943	18 848	669	15.7	16.0	8.7	17 664	15 828	611
120 -12	Nova Scotia	9 088	8 179	290	30.6	31.7	17.2	6 309	5 583	240
121 -13	New Brunswick	11 855	10 669	379	4.2	4.0	2.1	11 355	10 245	371
130	Saint John River:	28 792	25 913	920	38.9	41.9	17.4	17 596	15 046	760
130 -13	New Brunswick	23 278	20 950	744	47.1	51.0	20.8	12 322	10 274	589
130 -24	Québec	5 514	4 963	176	4.4	3.8	2.8	5 274	4 772	171
140 -24	Saguenay River	39 134	35 220	1 252	0.9	1.0	1.1	38 782	34 880	1 238
141 -24	Québec City area - Middle North Shore Rivers	91 415	82 273	2 925	1.7	1.9	1.9	89 864	80 717	2 869
142 -24	Chaudière River - Middle South Shore Rivers	53 269	47 942	1 704	3.8	5.4	6.9	51 270	45 361	1 587
143 -24	St. Maurice River	25 316	22 784	810	0	0	0	25 316	22 784	810
144 -24	Eastern Townships Rivers - Richelieu River	114 066	102 659	3 650	3.0	3.4	4.0	110 615	99 163	3 505
145 -24	Eastern Laurentians Rivers	30 193	27 173	966	4.8	5.3	5.6	28 730	25 731	912
146 -24	Montréal area Rivers	413 465	372 119	13 230	4.0	4.9	5.3	396 950	353 926	12 530
147	West St. Lawrence River:	50 613	45 551	1 618	24.3	46.4	65.9	38 321	24 434	551
147 -24	Québec	9 930	8 936	317	1.7	1.9	2.2	9 757	8 762	310
147 -35	Ontario	40 683	36 615	1 301	29.8	57.2	81.5	28 564	15 672	241
150	Lower Ottawa River:	130 459	117 413	4 174	17.8	57.9	51.6	107 257	49 482	2 021
150 -24	Québec	50 228	45 205	1 607	5.7	6.4	6.3	47 364	42 305	1 505
150 -35	Ontario	80 231	72 208	2 567	25.3	55.3	79.9	59 893	32 280	516
151	Upper Ottawa River:	38 081	34 272	1 218	35.4	42.6	49.8	24 608	19 666	612
151 -24	Québec	12 138	10 924	388	11.7	13.0	16.8	10 720	9 504	323
151 -35	Ontario	25 943	23 348	830	46.5	56.5	65.2	13 888	10 162	289
160 -35	Belleville-Napanee area Rivers	18 635	16 772	596	55.3	64.1	66.6	8 322	6 018	199
161 -35	Trent River	26 123	23 511	835	62.8	69.5	73.1	9 713	7 180	225
162 -35	Oshawa-Colborne area Rivers	27 188	24 469	870	67.5	75.5	74.0	8 831	6 003	226
163 -35	Toronto area Rivers	375 474	337 927	12 015	71.7	80.7	78.5	106 219	65 304	2 588
164 -35	Hamilton area Rivers	91 239	82 115	2 919	70.1	78.9	76.9	27 260	17 337	674
165 -35	Niagara Peninsula Rivers	62 263	56 037	1 992	48.3	66.0	75.8	32 184	19 073	482
170 -35	Grand River	66 639	59 975	2 132	70.2	78.7	77.2	19 867	12 781	486
171 -35	Lake Erie Shore Rivers	91 332	82 199	2 922	47.6	61.8	69.0	47 863	31 404	905
172 -35	Thames River	68 014	61 213	2 176	67.3	75.2	73.8	22 236	15 198	571
173 -35	Sydenham River	20 713	18 641	662	21.6	39.4	53.9	16 242	11 303	305

Appendix 6, Table 7

Estimated Daily Waste Discharged from Municipalities by Drainage Basin¹ (continued)

Drainage Basin	Waste Generated ²			Waste Removed ³			Waste Discharged		
	BOD ₅	Suspended Solids	Phos-phorus	BOD ₅	Suspended Solids	Phos-phorus	BOD ₅	Suspended Solids	Phos-phorus
	kilograms per day			percent			kilograms per day		
180 -35 South Huron Shore Rivers	20 749	18 674	663	51.6	60.3	70.1	10 042	7 419	198
181 -35 Georgian Bay Shore - Lake Simcoe Shore Rivers	37 724	33 951	1 207	43.4	52.7	58.3	21 365	16 072	503
182 -35 North Huron Shore Rivers	49 474	44 526	1 583	52.4	65.2	71.2	23 535	15 510	456
190 -35 Lake Superior Shore Rivers	13 426	10 083	429	31.5	63.7	74.4	9 193	3 656	110
Hudson Bay and Ungava Bay Basin									
200.2-24 Ungava Bay Coast Rivers	1 473	1 326	47	74.1	83.4	34.0	382	220	31
210.1-24 Rupert and Nottaway Rivers	4 145	3 730	132	7.7	8.7	3.8	3 826	3 407	127
210.2-24 Harricanaw River	6 312	5 681	201	1.5	1.3	0.5	6 217	5 609	200
210.3 Moose River:	13 791	12 411	440	26.7	39.0	9.3	10 108	7 574	399
210.3-24 Québec	3 365	3 028	107	3.7	3.0	0.9	3 242	2 936	106
210.3-35 Ontario	10 426	9 383	333	34.1	50.6	12.0	6 866	4 638	293
210.4-35 Albany River	746	671	23	63.4	71.4	30.4	273	192	16
211.1-61 West Hudson Bay Coast Rivers	441	397	14	7.7	6.5	14.3	407	371	12
211.3 Churchill River:	3 021	2 719	96	69.1	62.2	31.3	934	1 029	66
211.3-46 Manitoba	994	895	32	84.2	84.8	46.9	157	136	17
211.3-47 Saskatchewan	784	705	25	82.8	69.9	40.0	135	212	15
211.3-48 Alberta	1 243	1 119	39	48.4	39.1	12.8	642	681	34
220 -46 Nelson River	2 374	2 137	75	47.6	63.8	18.7	1 244	774	61
230 Lake Winnipeg Shore Rivers:	9 057	8 151	289	50.2	63.6	23.2	4 506	2 966	222
230 -35 Ontario	7 546	6 791	241	53.5	70.0	23.2	3 512	2 039	185
230 -46 Manitoba	1 511	1 360	48	34.2	31.8	22.9	994	927	37
231 -46 Red River	78 464	70 617	2 510	78.4	87.5	34.5	16 952	8 842	1 643
232 Dauphin River:	3 351	3 015	106	61.3	51.2	26.4	1 296	1 471	78
232 -46 Manitoba	3 311	2 980	105	62.1	51.8	26.7	1 256	1 436	77
232 -47 Saskatchewan	40	35	1	0	0	0	40	35	1
240 Assiniboine and Souris Rivers:	10 969	9 872	350	73.7	76.2	33.7	2 881	2 347	232
240 -46 Manitoba	7 560	6 804	241	70.7	76.2	34.4	2 218	1 622	158
240 -47 Saskatchewan	3 409	3 068	109	80.6	76.4	32.1	663	725	74
241 -47 Qu'Appelle River - Old Wives Lake	19 315	17 383	618	89.1	74.2	30.6	2 113	4 481	429
250 Saskatchewan River:	2 298	2 068	73	48.2	57.2	17.8	1 190	886	60
250 -46 Manitoba	2 002	1 802	64	52.1	57.9	18.8	958	758	52
250 -47 Saskatchewan	296	266	9	21.6	51.9	11.1	232	128	8
251 -48 Upper North Saskatchewan River	2 166	1 949	69	85.3	80.7	34.8	319	377	45
252 Lower North Saskatchewan River:	98 200	88 379	3 142	64.8	81.4	28.3	34 566	16 396	2 253
252 -47 Saskatchewan	10 038	9 032	321	67.0	75.1	37.7	3 310	2 251	200
252 -48 Alberta	88 162	79 347	2 821	64.5	82.2	27.2	31 256	14 145	2 053
253 South Saskatchewan River and Red Deer River:	46 344	41 710	1 482	55.0	61.8	20.0	20 835	15 931	1 186
253 -47 Saskatchewan	15 335	13 802	490	29.6	60.7	6.9	10 789	5 424	456
253 -48 Alberta	31 009	27 908	992	67.6	62.4	26.4	10 046	10 507	730
254 -48 Bow River	86 980	78 282	2 783	71.6	84.6	30.4	24 673	12 024	1 937
Arctic Ocean Basin									
300.1-61 Mackenzie River	901	811	28	43.6	36.5	17.9	508	515	23
300.2 Great Slave Lake Shore Rivers:	1 270	1 142	39	60.4	50.4	20.5	503	566	31
300.2-48 Alberta	154	138	4	0	0	0	154	138	4
300.2-61 Northwest Territories	1 116	1 004	35	68.7	57.4	22.9	349	428	27
300.3 Liard River:	959	863	30	87.5	73.0	33.3	120	233	20
300.3-59 British Columbia	795	715	25	90.1	75.1	32.0	79	178	17
300.3-60 Yukon	164	148	5	75.0	62.8	40.0	41	55	3
301 -48 Athabasca River	2 516	2 264	80	63.2	52.8	28.8	925	1 069	57
302 Peace River:	8 550	7 695	273	84.6	71.0	30.8	1 314	2 235	189
302 -48 Alberta	2 608	2 347	83	74.9	63.8	30.1	655	850	58
302 -59 British Columbia	5 942	5 348	190	88.9	74.1	31.1	659	1 385	131
330.1-61 Mainland Arctic Coast Rivers	104	94	3	0	0	0	104	94	3
330.2-61 Arctic Islands Rivers	684	615	19	11.0	8.9	5.3	609	560	18
Pacific Ocean Basin									
400 -59 Columbia River	10 125	9 112	324	59.9	67.9	22.8	4 065	2 927	250
401 -59 Okanagan River	11 620	10 458	371	35.4	39.3	39.1	7 512	6 347	226
402 -59 Similkameen River	498	448	15	72.7	60.7	20.0	136	176	12
410 -59 Upper Fraser River	9 904	8 914	316	48.8	52.4	21.5	5 072	4 239	248
411 -59 Thompson River	9 702	8 732	310	56.4	63.1	63.2	4 234	3 224	114
412 -59 Lower Fraser River	27 228	24 505	871	6.3	7.1	3.0	25 500	22 756	845
420.1-60 Yukon River	4 802	4 322	153	81.0	67.5	28.1	913	1 403	110
430 -60 Alsek River	53	47	1	69.8	57.4	100.0	16	20	0
431.1-59 Pacific Ocean, North Coast Rivers	2 911	2 620	93	90.0	75.0	30.1	291	655	65
431.2-59 Skeena River	4 905	4 414	156	19.7	28.5	7.7	3 938	3 156	144
431.3-59 Queen Charlotte Islands Rivers	137	123	4	0	0	0	137	123	4

Appendix 6, Table 7

Estimated Daily Waste Discharged from Municipalities by Drainage Basin¹ (concluded)

Drainage Basin	Waste Generated ²			Waste Removed ³			Waste Discharged		
	BOD ₅	Suspended Solids	Phos-phorus	BOD ₅	Suspended Solids	Phos-phorus	BOD ₅	Suspended Solids	Phos-phorus
	kilograms per day			percent			kilograms per day		
432.1-59 Pacific Ocean, South Coast Rivers	16 601	14 941	531	30.7	61.2	9.0	11 503	5 795	483
432.2-59 Northern Vancouver Island Rivers	11 833	10 649	378	27.8	40.0	10.1	8 543	6 392	340
433 -59 Southern Vancouver Island Rivers	50 815	45 733	1 626	5.4	5.4	2.1	48 083	43 269	1 592
Gulf of Mexico Basin									
500 Milk - Missouri Tributary Rivers:	206	185	6	86.9	72.4	33.3	27	51	4
500 -47 Saskatchewan	8	7	0	0	0	...	8	7	0
500 -48 Alberta	198	178	6	90.4	75.3	33.3	19	44	4
Canada	2 892 451	2 486 870	88 443	37.2	45.3	37.2	1 744 253	1 360 488	55 568

¹ Data obtained from MUNDAT (a national inventory of waterworks and wastewater systems in Canada). The updating of the information occurs on a continuous basis, as received from participating agencies. The data presented here are current as of May 1984.

² Discharge coefficients were applied to the average daily wastewater received by sewage collection systems. These were 0.25 kg./cu. metres of Biochemical Oxygen Demand (BOD₅), 0.225 kg./cu. metres of suspended solids and 0.008 kg./cu. metres of phosphorus. This assumes the composition of wastewater is identical across Canada. For residential, commercial and institutional sectors this may be valid, however this may not be the case for industrial wastewater.

³ Waste removed accounts for the portion of the wastewater flow undergoing primary, secondary and lagoon treatment. In calculating the amount of waste removed by treatment, standard waste removal efficiency coefficients were used, i.e. primary treatment: 25 percent BOD₅ removal, 60 percent suspended solids removal and 5 percent phosphorus removal; secondary treatment: 80 percent BOD₅ removal, 90 percent suspended solids removal and 35 percent phosphorus removal; lagoon treatment: 90 percent BOD₅ removal, 75 percent suspended solids removal and 30 percent phosphorus removal. The untreated proportion of wastewater has also been considered in this calculation.

Source:

Environment Canada, Environmental Protection Service, MUNDAT Data Base, special tabulation.

Appendix 7, Table 1
Flora and Fauna Species with Designated Status¹, 1985

Mammal Species	1985 Status
Eastern Mole <i>Scalopus aquaticus</i>	Rare
Vancouver Island Marmot <i>Marmota vanancouverensis</i>	Endangered
Black-tailed Prairie Dog <i>Cynomys ludovicianus</i>	Rare
Fox Squirrel <i>Sciurus niger</i>	N.I.A.C.
Pocket Gopher <i>Geomys bursarius</i>	Rare
Right Whale <i>Balaena glacialis</i>	Endangered
Bowhead Whale <i>Balaena mysticetus</i>	Endangered
Swift Fox <i>Vulpes velox</i>	Extirpated
Grey Fox <i>Urocyon cinereoargenteus</i>	Rare
Grizzly Bear <i>Ursus arctos horribilis</i>	N.I.A.C.
Newfoundland Marten <i>Martes americana atrata</i>	N.I.A.C.
Black-footed Ferret <i>Mustela nigripes</i>	Extirpated
Badger <i>Taxidea taxus</i>	N.I.A.C.
Sea Otter <i>Enhydra lutris</i>	Endangered
Eastern Cougar <i>Felis concolor cougar</i>	Endangered
Peary Caribou <i>Rangifer tarandus pearyi</i>	Threatened
Wood Bison <i>Bison bison athabascae</i>	Endangered
Wolverine <i>Gulo gulo</i>	Rare
Long-tailed Weasel (Prairies) <i>Mustela frenata longicauda</i>	Threatened
Humpback Whale <i>Megaptera novaeangliae</i>	
North Atlantic Population	Rare
North Pacific Population	Threatened
St. Lawrence White Whale (Beluga) <i>Delphinapterus leucas</i>	Endangered
Beaufort Sea White Whale (Beluga)	N.I.A.C.
Blue Whale <i>Balaenoptera musculus</i>	Rare
Mountain Beaver <i>Aplodontia rufa</i>	N.I.A.C.
Queen Charlotte Islands Ermine <i>Mustela erminea haidarum</i>	Rare
Woodland Caribou: (by population) <i>Rangifer tarandus caribou</i>	
Dawson Woodland Caribou	Extinct
Western Woodland Caribou	Rare
Northeastern Woodland Caribou	N.I.A.C.
Maritime Woodland Caribou	Threatened
Newfoundland Woodland Caribou	N.I.A.C.

Bird Species	1985 Status
White Pelican <i>Pelecanus erythrorhynchos</i>	Threatened
Double-crested Cormorant <i>Phalacrocorax auritus</i>	N.I.A.C.
Trumpeter Swan <i>Olor buccinator</i>	Rare
Ferruginous Hawk <i>Buteo regalis</i>	Threatened
Gyrfalcon <i>Falco rusticolus</i>	N.I.A.C.
Peregrine Falcon: <i>Falco peregrinus</i>	
<i>Pealei</i>	Rare
<i>Tundrius</i>	Threatened
<i>Anatum</i>	Endangered
Greater Prairie Chicken <i>Tympanuchus cupido pinnatus</i>	Endangered
Whooping Crane <i>Grus americana</i>	Endangered
Greater Sandhill Crane <i>Grus canadensis</i>	N.I.A.C.
Piping Plover <i>Charadrius melodus</i>	Endangered
Eskimo Curlew <i>Numenius borealis</i>	Endangered
Ivory Gull <i>Pagophila eburnea</i>	Rare
Caspian Tern <i>Sterna caspia</i>	Rare
Burrowing Owl <i>Athene cunicularia</i>	Threatened
Great Gray Owl <i>Strix nebulosa</i>	Rare
Kirtland's Warbler <i>Dendroica kirtlandii</i>	Endangered
Ipswich Sparrow <i>Passerculus sandwichensis princeps</i>	Rare
Ross' Gull <i>Rhodostethia rosea</i>	Rare
Red-Necked Grebe <i>Podiceps grisegena</i>	N.I.A.C.
Prairie Falcon <i>Falco mexicanus</i>	N.I.A.C.
Red-Shouldered Hawk <i>Buteo lineatus</i>	Rare
Cooper's Hawk <i>Accipiter cooperii</i>	Rare
Prothonotary Warbler <i>Protonotaria citrea</i>	Rare
Henslow's Sparrow <i>Ammodramus henslowii</i>	Threatened
Eastern Bluebird <i>Sialia sialis</i>	Rare
Barn Owl <i>Tyto alba</i>	Rare
Bald Eagle <i>Haliaeetus leucocephalus</i>	N.I.A.C.
Merlin <i>Falco columbarius</i>	N.I.A.C.
King Rail <i>Rallus elegans</i>	Rare
Prairie Warbler <i>Dendroica discolor</i>	Rare

Appendix 7, Table 1

Flora and Fauna Species with Designated Status¹, 1985 (concluded)

Reptile Species		1985 Status
Leatherback Turtle	<i>Dermochelys coriacea</i>	Endangered
Fish Species		1985 Status
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	Rare
Speckled Dace	<i>Rhinichthys osculus</i>	Rare
Giant Stickleback	<i>Gasterosteus</i> sp.	Rare
Blueback Herring	<i>Alosa aestivalis</i>	N.I.A.C.
Spotted Gar	<i>Lepisosteus oculatus</i>	Rare
Spotted Sucker	<i>Minytrema melanops</i>	Rare
Silver Shiner	<i>Notropis photogenis</i>	Rare
River Redhorse	<i>Moxostoma carinatum</i>	Rare
Charlotte Unarmoured Stickleback	<i>Gasterosteus aculeatus</i>	Rare
Acadian Whitefish	<i>Coregonus canadensis</i>	Endangered
Shorthead Sculpin	<i>Cottus confusus</i>	Threatened
Longjaw Cisco	<i>Coregonus alpenae</i>	Extinct
Blue Walleye	<i>Stizostedion vitreum</i>	Extinct
Pugnose Shiner	<i>Notropis anogenus</i>	Rare
Gravel Chub	<i>Hybopsis x-punctata</i>	Endangered
Silver Chub	<i>Hybopsis storeriana</i>	Rare
Brindled Madtom	<i>Noturus miurus</i>	Rare
Pugnose Minnow	<i>Notropis emilae</i>	Rare
Bigmouth Shiner	<i>Notropis dorsalis</i>	Rare
Central Stoneroller	<i>Camptostoma anomalum</i>	Rare
Blackstripe Topminnow	<i>Fundulus notatus</i>	Rare
Plant Species		1985 Status
Furbish Lousewort	<i>Pedicularis furbishiae</i>	Endangered
Small White Lady Slipper	<i>Cypripedium candidum</i>	Endangered
Willow	<i>Salix planifolia tyrellii</i>	Threatened
Thrift	<i>Armeria maritima interior</i>	Threatened
Small Whorled Pogonia	<i>Isotria medeoloides</i>	Endangered
Kentucky Coffee Tree	<i>Gymnocladus dioica</i>	Threatened
Blue Ash	<i>Fraxinus quadrangulata</i>	Threatened
Broad Beech Fern	<i>Phegopteris hexagonaptera</i>	Rare
Southern Maidenhair Fern	<i>Adiantum capillus-veneris</i>	Endangered
Green Dragon	<i>Arisaema draconitium</i>	Rare
Plymouth Gentian	<i>Sabatia kennedyana</i>	Threatened
Pink Coreopsis	<i>Coreopsis rosea</i>	Endangered
False Mermaid	<i>Floerkea proserpinacoides</i>	N.I.A.C.
American Water-Willow	<i>Justicia americana</i>	Threatened
Shumard Oak	<i>Quercus shumardii</i>	Rare
Hop Tree	<i>Ptelea trifoliata</i>	Rare
Giant Helleborine	<i>Epipactis gigantea</i>	Threatened
Cucumber Tree	<i>Magnolia acuminata</i>	Endangered
Pink Milkwort	<i>Polygala incarnata</i>	Endangered
Mosquito Fern	<i>Azolla mexicana</i>	Threatened
Soapweed	<i>Yucca glauca</i>	Rare
Heart-Leaved Plantain	<i>Plantago cordata</i>	Endangered
Eastern Prickly Pear Cactus	<i>Opuntia humifusa</i>	Endangered
Bluehearts	<i>Buchnera americana</i>	Threatened
Water Pennywort	<i>Hydrocotyle umbellata</i>	Endangered
Dwarf Hackberry	<i>Celtis tenuifolia</i>	Rare

¹ A categorization of species by degree of threat to their continued existence has been established by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This list is as follows:

Rare Species: Any indigenous species of fauna or flora that, because of its biological characteristics, or because it occurs at the fringe of its range, or for some other reason, exists in low numbers or in very restricted areas in Canada but is not a threatened species.

Threatened Species: Any indigenous species of fauna or flora that is likely to become endangered in Canada if the factors affecting its vulnerability do not become reversed.

Endangered Species: Any indigenous species of fauna or flora whose existence in Canada is threatened with immediate extinction through all or a significant portion of its range, owing to the action of man.

Extirpated Species: Any indigenous species of fauna or flora no longer existing in the wild in Canada but existing elsewhere

Extinct Species: Any species of fauna or flora formerly indigenous to Canada but no longer existing anywhere.

N.I.A.C.: Not in any category; current status is uncertain

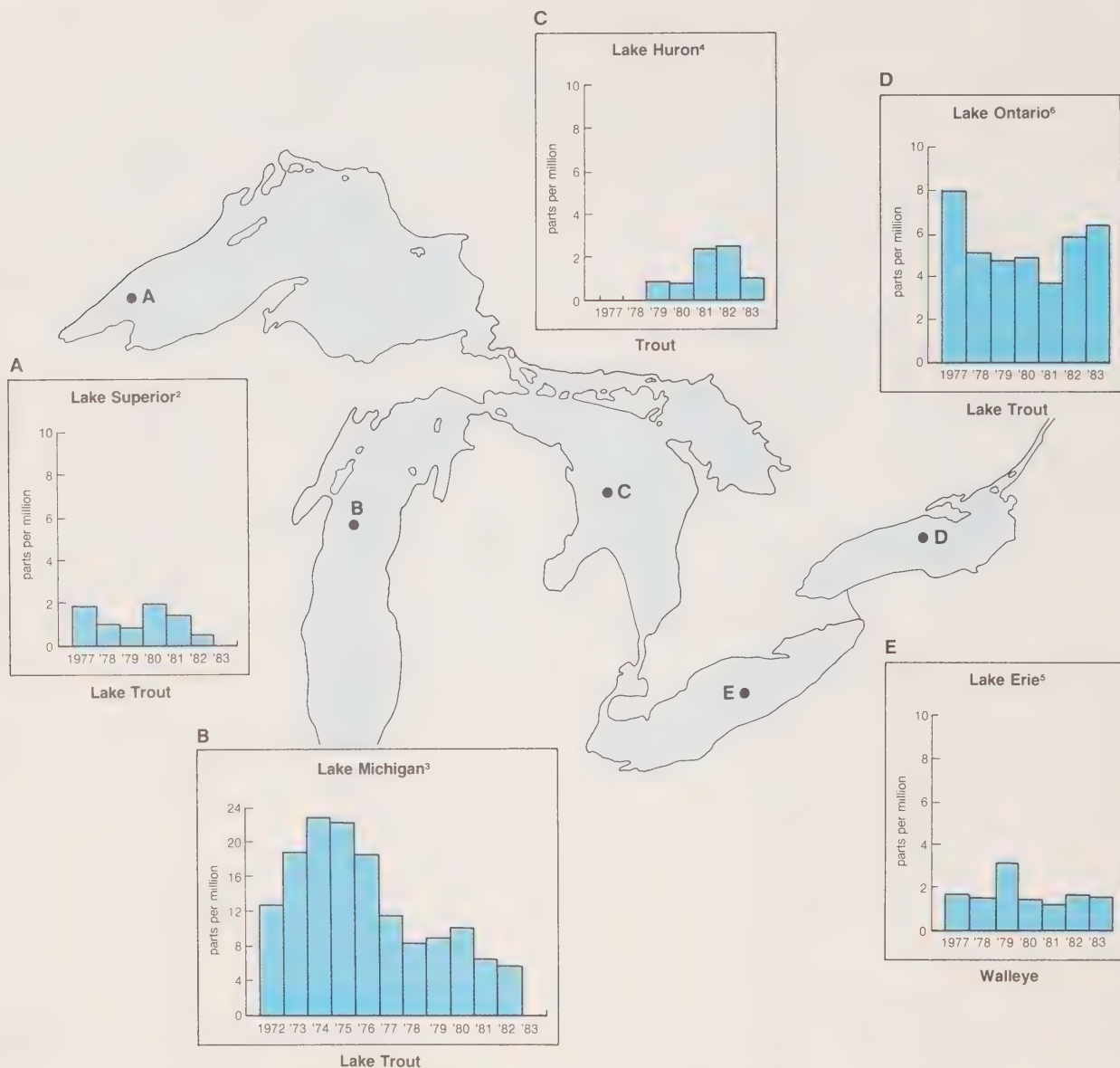
Source:

Environment Canada, Canadian Wildlife Service, The Committee on the Status of Endangered Wildlife in Canada, (COSEWIC), 1985.

Note:

COSEWIC was founded in 1977 by the Federal-Provincial Wildlife Conference, to which it reports annually.

Appendix 7 Map 2

Mean PCB Concentrations¹ in Whole Fish Samples of Trout and Walleye in the Great Lakes, 1972 to 1983

¹ Measured in milligrams per kilogram wet weight of whole fish (parts per million). The Great Lakes Agreement objective for PCBs is 0.1 parts per million for whole fish.

² Data are for fish collected from the Apostle Islands area of the western basin of Lake Superior.

³ There is a sport fish consumption advisory for Lake Michigan for large lake trout, carp and brown trout. It is recommended that no one should eat these fish.

⁴ Includes data for splake (hybrid of brown trout and lake trout). Since sampling locations are not fixed in Lake Huron, changes in measured values may reflect geographic differences and not temporal changes.

⁵ There are no lake trout in Lake Erie; walleye are the top predators. Since these fish have a lower fat content than trout, they accumulate chlorinated hydrocarbons (such as PCBs) to a lesser extent.

⁶ All fish were collected for the whole of Lake Ontario and were at least four years old. This is the only lake where the age of the fish have been determined.

Source:

International Joint Commission, 1985 Report on Great Lakes Water Quality, Windsor, Ontario.

Note:

These species are top-predators in the food chain and are at the end of a process of slow accumulation of contaminants in the ecosystem. Larger, older fish generally have higher contaminant levels. The monitoring program is designed to show "whole lake" response to the regulation of all types of contaminants loadings (see Maps 7.2.2 to 7.2.4 for examples of early warning responses to point sources).

Appendix 7 Map 3

Evidence of Lip Tumours on White Suckers from Lakes Huron and Ontario, 1981-1983¹



¹ Prevalence of lip papillomas (tumours) in white suckers as a percentage of total male and female fish greater than 40 cm (fork length). These fish were collected during spring spawning runs of 1981 through 1983. The number of fish collected at each site was approximately 100.

Source:
International Joint Commission, 1983 Report on Great Lakes Water Quality, Appendix, Great Lakes Surveillance, Windsor, Ontario.

Note:
Measure of contaminants in tissues of organisms such as fish and birds help to determine the pathways that these substances take once they have entered the environment. However, toxicological data are expensive to produce given the

overwhelming number of chemicals that have been identified in ecosystems. The health of individual organisms is a direct way to ascertain if exposure to man-made substances has adverse effects. In the 1960's, the reproductive failures of top-predator bird species drew attention to substances such as DDT and led to the prohibition of the use of many pesticides. Today a number of Great Lakes fish show elevated frequency of pathological anomalies, eg tumours, growth abnormalities. Although the individual chemical stresses have not been identified (as with the example of DDT), health surveillance provides an early warning mechanism identifying location and species. The Great Lakes Water Quality Board in its 1983 report to the IJC suggests that

"This type of monitoring, if acceptable could provide an appropriate link between contaminated environments and biological responses."

Appendix 8, Table 1
Federal and Provincial Environmental Legislation (a) Canada and Eastern Provinces

Subject	Canada	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Québec
Air, Atmosphere	Motor Vehicle Safety Act, 1970, 1980 Weather Modification Information Act, 1971, 1974 Clean Air Act, 1971, 1974		Highway Traffic Act, 1974		Motor Vehicle Act, 1971, 1983	Artificial Inducement of Rain Act, 1970, 1979
Water	Boundary Waters Treaty, 1909 International River Improvement Act, 1955 Canada Water Act, 1970 Arctic Waters Pollution Prevention Act, 1970 Northern Inland Waters Act, 1970 Canada Shipping Act 1970, 1979 Navigable Waters Protection Act, 1970 National Housing Act, 1970	Water Protection Act, 1964, 1970, 1981 Water Resources and Pollution Control Act, 1967 Well Drilling Act, 1981	Well Drillers Act, 1974 Water and Sewerage Act, 1974 Water Authority Act, 1965 Beaches Protection Act, 1963	Well Drilling Act, 1967 Beaches Preservation and Protection Act, 1975 Marshland Reclamation Act, 1967	Flood and Storm Damage Act, 1973, 1976 Dams and Sluiceways Act, 1966 Marshland Reclamation Act, 1977, 1979	Water Courses Act, 1964, 1978
Land-Use and Heritage	National Parks Acts, 1930, 1970 Historic Sites and Monuments Act, 1953, 1970 Territorial Lands Act, 1955, 1972 Indian Act, 1970, 1979	Provincial Parks Act, 1953 Crown Lands Act, 1970, 1975 Development Areas (Lands) Act, 1970, 1982 Environmental Assessment Act, 1980, 1981 Wilderness and Ecological Reserves Act, 1980 Historic Objects, Sites and Records Act, 1973	Recreation Development Act, 1969, 1974 Planning Act, 1968 Community Improvement Act, 1968	Provincial Parks Act, 1967 Lands and Forests Act, 1967 Special Places Protection Act, 1980 Trails Act, 1978 Camping Establishments Regulation Act, 1969 Historic Property Designation Act, 1976 Historic Objects Protection Act, 1970	Ecological Reserves Act, 1973, 1979 Parks Act, 1977, 1982 Community Planning Act, 1972 Municipal Heritage Preservation Act, 1978	Provincial Parks Act, 1964, 1977 Lands and Forest Act, 1964, 1974 James Bay Development Act, 1971 Ecological Reserves Act, 1974, 1977, 1982 Roadside Advertising Act, 1965 Historic Monuments Act, 1963
Hazardous Chemicals/Products	Atomic Energy Control Act, 1946, 1976 Food and Drug Act, 1954 Hazardous Products Act, 1969, 1983 Radiation Emission Devices Act, 1970, 1982 Railway Act, 1970, 1978 National Transportation Act, 1970, 1980 Nuclear Liability Act, 1970	Pesticides Control Act, 1970, 1981 Dangerous Goods Transportation Act, 1982 Waste Material (Disposal) Act, 1973	Dangerous Goods Transportation Act, 1981 Mineral Resources Act, 1978	Pest Control Products Act, 1970 Dangerous Goods Transportation Act, 1982	Pesticide Control Act, 1973, 1982 Pipeline Act, 1976, 1983	Transport Act, 1972, 1981
Hazardous Chemicals/Products — Concluded	Pest Control Products Act, 1970 Environmental Contaminants Act, 1975, 1980 Ocean Dumping Control Act, 1975, 1981 Transportation of Dangerous Goods Act, 1980 Northern Pipeline Act, 1978					

Appendix 8, Table 1

Federal and Provincial Environmental Legislation (continued) (a) Canada and Eastern Provinces

Subject	Canada	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec
Solid Waste/ Noise	Aeronautics Act, 1970	Waste Material Disposal Act, 1971, 1981 Ore Treatment Tailings Act, 1973 Quarry Materials Act, 1975	Mineral Resources Act, 1974 Automobile Junk Yards Act, 1969 Unightly Premises Act, 1966	Beverage Containers Act, 1975 Mineral Resources Act, 1975	Highway Act, 1973, 1983 Quarriable Substances Act, 1973, 1983 Mining Act, 1973, 1983 Beverage Containers Act, 1977, 1980	Mining Act, 1965
Agriculture	Fertilizers Act, 1957, 1970 Pesticide Residue Compensation Act, 1970	Rural Agricultural Development Act, 1973	Agricultural Rehabilitation and Development Act, 1962 Plant Diseases Eradication Act, 1974 Agricultural Chemicals Act, 1972, 1974	Agricultural and Marketing Act, 1967 Weed Control Act, 1967	Agriculture Rehabilitation and Development Act, 1973 Plant Diseases Act, 1968, 1978 Potato Disease Eradication Act, 1979	Plant Protection Act, 1964, 1973 Protection of Agricultural Land Act, 1978 Agricultural and Rural Development Act, 1963 Agriculture and Colonization Act, 1962
Fisheries	Fisheries Act, 1970, 1977 Fishing and Recreational Harbours Act, 1978	Fisheries Act, 1970, 1973, 1980 Fisheries Development Authority, 1982		Fisheries Act, 1977 Agriculture Act, 1983 Fisheries Development Act, 1978	Fish and Wildlife Act, 1981	Tourism, Fish and Game Act, 1963
Forestry	Eastern and Rocky Mountain Forest Conservation Act, 1947 Forest Development and Resources Act, 1966, 1970	Forest Fires Act, 1970 Forest Travel Act, 1970 Newfoundland and Labrador Forest (Protection) Act, 1967, 1970 Forest Exchange and Acquisitions Act, 1970 Forest Land Management and Tax Act, 1974 Forest and Lands Act, 1981	Forestry Act, 1956 Fire Prevention Act, 1983	Lands and Forests Act, 1967 Forest Improvement Act, 1967 Forest Improvement Act, 1962, 1965	Crown Lands and Forest Act, 1976, 1980, 1983 Forest Fires Act, 1970, 1973, 1983	Lands and Forests Act, 1964, 1974 Tree Protection Act, 1964 Fire Prevention Act, 1968
Wildlife	Migratory Birds Convention Act, 1917, 1970 Game Export Act, 1970 Canada Wildlife Act, 1973	Wildlife Act, 1970	Fish and Game Protection Act, 1974		Apiary Inspection Act, 1973, 1974 Fish and Wildlife Act, 1980, 1984 Wildlife Council, 1968	Tourism, Fish and Game Act, 1964 Wildlife Conservation Act, 1969, 1978
Energy	Oil and Gas Production Conservation Act, 1969, 1970 National Energy Board Act, 1970, 1975		Oil, Natural Gas and Minerals Act, 1971	Tidal Power Corporation Act, 1971	Underground Storage Act, 1978 Oil and Natural Gas Act, 1976, 1983	
General	Income Tax Act, 1966, 1977 Government Organization Act, 1970, 1979 Canadian Environment Week Act, 1971	Health Act, 1970, 1979 Department of Environment Act, 1981 Provincial Affairs and Environment Act, 1973	Public Health Act, 1974, 1980 Environmental Protection Act, 1975, 1983	Public Health Act, 1967, 1973 Environmental Protection Act, 1973, 1977 Environmental Pollution Act, 1970	Clean Environment Act, 1973, 1983 Health Act, 1973, 1983 Emergency Measures Act, 1978 Clean Environment Act, 1971	Environmental Quality Act, 1973, 1983 Public Health Protection Act, 1972, 1979 Ministry of the Environment Act, 1979, 1982

Appendix 8, Table 1

Federal and Provincial Environmental Legislation (continued) (b) Western Provinces and Territories

Subject	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon (Y) and Northwest Territories (N)
Air/Atmosphere	Air Pollution Control Act, 1967	Mining and Metallurgy Act, 1970	Air Pollution Control Act, 1965, 1978	Clean Air Act, 1971, 1983	Weather Modification Act, 1973, 1983 Motor Vehicle Act, 1979 Geothermal Resources Act, 1973, 1982	
Water	Ontario Water Resources Act, 1956, 1983 Drainage Act, 1963, 1975, 1980 Lakes and Rivers Improvement Act, 1970, 1980 Beach Protection Act, 1970, 1980 Shoreline Property Assistance Act, 1973	Water Reserves Administration Act, 1970 Rivers and Streams Act, 1970, 1972 Ground Water and Water Wells Act, 1970, 1972 Water Rights Act, 1983 Construction of Dykes Act, 1966 Water Control and Conservation Branch Act, 1967	Ground Water Conservation Act, 1959, 1978 Water Pollution Control and Assistance Act, 1969 Pollution Control Act, 1971, 1984 Water Corporation Act, 1984 Drainage Approval Board Act, 1984 Drainage Control Act, 1980 Water Resources Management Act, 1972 Sewage Drainage Inquiry Act, 1969	Water Resources Act, 1970, 1978 Clean Water Act, 1971, 1983 Ground Water Development Act, 1980 Water Resources Commission Act, 1983	Water Act, 1960, 1979 River Bank Protection Act, 1979	Water Resources Agreement Ordinance 1983 (N)
Land Use and Heritage	Public Lands Act, 1970, 1972 Conservation Authorities Act, 1968, 1970, 1980 Provincial Parks Act, 1970 Wilderness Areas Act, 1970, 1980 Environmental Assessment Act, 1974, 1975, 1981 Land Corporation Act, 1975 Niagara Escarpment Planning and Development Act, 1973 Niagara Escarpment Protection Act, 1970 Ontario Heritage Act, 1975	Crown Lands Act, 1970 Provincial Park Lands Act, 1972 Ecological Reserves Act, 1981 Northern Affairs Act, 1974 Surface Rights Act, 1983 Heritage Manitoba Act, 1974 Resource Conservation Districts Act, 1970	Provincial Parks and Protected Areas Act, 1965, 1978 Conservation and Development Act, 1965, 1978 Environmental Assessment Act, 1980 Ecological Reserves Act, 1980 Regional Parks Act, 1979 Saskatchewan Heritage Act, 1975	Public Lands Act, 1966, 1970, 1980 Wilderness Areas Act, 1971, 1981 Provincial Parks Act, 1964, 1974 Land Surface Conservation Act, 1973, 1983 Surface Rights Act, 1972, 1983 Special Areas Act, 1964 Surface Reclamation Act, 1963	Park Act, 1965 Land Act, 1965, 1970 Environment and Land Use Act, 1971, 1979 Ecological Reserves Act, 1971, 1983 Greenbelt Act, 1977 Heritage Conservation Archeological and Historic Sites Act, 1972	Commissioners Land Ordinance, 1969 (N) Historic Resources Ordinance 1970 (N) Territorial Parks Ordinance 1973, 1983 (N) Travel and Tourism Ordinance, 1983 (N) Lands Ordinance, 1971(Y)
Hazardous Chemicals/Products	Pesticides Act, 1971, 1973, 1982 Highway Traffic Act, 1980 Dangerous Goods Transportation Act, 1981	Pesticide and Fertilizer Control Act, 1976 Transportation of Dangerous Goods Act, 1983	Radiation Health and Safety Act, 1978 Pest Control Products Act, 1978	Agriculture Products Act, 1970, 1982 Radiation Protection Act, 1970, 1980 Hazardous Chemicals Act, 1978, 1982 Pipeline Act, 1975, 1981 Transportation of Dangerous Goods Act, 1982 Special Waste Management Corporation Act, 1982	Pesticide Control Act, 1977, 1980 Pipeline Act, 1979, 1981	Pesticide Ordinance, 1970 Transport of Dangerous Goods Ordinance, 1982

Appendix 8, Table 1

Federal and Provincial Environmental Legislation (continued) (b) Western Provinces and Territories

Subject	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon (Y) and Northwest Territories (N)
Solid Waste/ Noise	Mining Act, 1980 Pits and Quarries Control Act, 1980 Ontario Waste Management Corporation, 1981 Motorized Snow Vehicles Act, 1968, 1982	Mines Act, 1973 Industrial Minerals Drilling Act, 1977 Snow Vehicles Act, 1970	Litter Control Act, 1970, 1973, 1978 Mineral Resources Act, 1978	Litter Act, 1972, 1980 Beverage Containers Act, 1977, 1982 Quarries Regulation Act, 1980 Snow Vehicles Act, 1979	Litter Act, 1970, 1979 Waste Management Act, 1982, 1983 Placer Mining Act, 1974 Mines Act, 1980 Mineral Act, 1977	Noise Prevention Ordinance, 1971 (Y)
Agriculture	Agricultural Rehabilitation and Development Act, 1962, 1970 Plant Diseases Act, 1970, 1980 Abandoned Orchards Act, 1966, 1978 Tile Drainage Act, 1909, 1983 Weed Control Act, 1927, 1973 Wild Rice Harvesting Act, 1960, 1971 Top Soil Preservation Act, 1977, 1980	Wild Rice Act, 1983 Farmlands Protection Act, 1977 Noxious Weeds Act, 1968 Control of Predators Act, 1965 Plant, Pets and Diseases Act, 1963 Dutch Elm Disease Act, 1980	Agricultural Development and Adjustment Act, 1965, 1978	Soil Conservation Act, 1970, 1980 Irrigation Act, 1970, 1980 Weed Control Act, 1972, 1979 Agricultural Pests Act, 1974	Agriculture Land Commission, 1972, 1977 Soil Conservation Act, 1977, 1979 Range Act, 1978 Agriculture and Rural Development Act, 1982	
Fisheries	Game and Fish Act, 1962, 1970	Fisheries Act, 1969 Fisheries Assistance and Pollution Liability Act, 1970	Fisheries Act, 1965, 1978		Fisheries Act, 1982	Freshwater Fish Marketing Ordinance (N)
Forestry	Tree Planting Act, 1927, 1979 Forestry Act, 1970 Forest Fires Protection Act, 1968, 1970 Forest Tree Pest Control Act, 1968, 1970 Crown Timber Act, 1970 Woodlands Improvement Act, 1966, 1970	Forest Act, 1964, 1974	Forest Act, 1965, 1978 Prairie and Forest Fires Act, 1965, 1978, 1980	Forest Reserves Act, 1964, 1970 1980 Forests Act, 1971, 1980 Forest and Prairie Protection Act, 1971, 1980	Forest Act, 1978 Forest and Range Resource Fund, 1980	Forest Protection Ordinance, 1971 (Y) Forest Protection Ordinance, 1959 (N)
Wildlife	Fish and Game Act, 1962, 1970 Bee Act, 1970 Tourism Act, 1970, 1980 Endangered Species Act, 1971, 1980	Wildlife Act, 1980 Bee Act 1970 Wildlife Foundation of Manitoba, 1966	Wildlife Act, 1979 Critical Wildlife Habitat Protection Act, 1984 Apiaries Act, 1978	Wildlife Act, 1970 Bee Act, 1972 Recreation, Parks and Wildlife Act, 1977	Dogwood, etc., Protection Act, 1960 Creston Valley Wildlife Act, 1968, 1977 Wildlife Act, 1966, 1973, 1982 Bee Act, 1980	Wildlife Ordinance, 1978 (N)
Energy	Petroleum Resources Act, 1971	Manitoba Oil and Gas Corporation, 1983 Manitoba Energy Council Act, 1980 Manitoba Energy Authority, 1980	Water Power Act, 1965, 1978 Oil and Gas Conservation and Development Act, 1973, 1978	Oil and Gas Conservation Act, 1970, 1976 Oil Sands Conservation Act, 1969, 1983 Energy Resources Conservation Act, 1971	Underground Storage Act, 1964 Coal Act, 1974	Petroleum Protection Ordinance, 1976 (N)

Appendix 8, Table 1

Federal and Provincial Environmental Legislation (concluded) (b) Western Provinces and Territories

Subject	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon (Y) and Northwest Territories (N)
General	Environmental Protection Act, 1971, 1983 Public Health Act, 1980 Health Protection Act, 1983 Pollution Abatement Incentives Act, 1970	Public Health Act, 1970, 1980 Clean Environment Act, 1968, 1970, 1974, 1976, 1980	Department of the Environment Act, 1972, 1984 Public Health Act, 1968, 1978 Environmental Management and Protection Act, 1984 Tourism and Renewable Resources Act, 1974	Public Health Act, 1970, 1980 Environmental Council Act, 1970, 1980 Department of Environment Act, 1971, 1981 Environmental Research Trust Act, 1980, 1981 Environment Conservation Act, 1970	Department of Environment Act, 1960, 1980 Health Act, 1971, 1983 Environmental Management Act, 1981, 1983 Pollution Control Act, 1967, 1974	Public Health Ordinance 1957, 1977 (N) Area Development Ordinance, 1956, 1979, (N) Environmental Protection Ordinance, 1973 (N) Scientists Ordinance, 1974 (N) Public Health Ordinance 1971 (Y) Area Department Ordinance, 1971 (Y)

Source:

Statutes of Canada and Provinces, and Ordinances of Territories, various years; prepared by Dr. P. Bird, Environment Canada, 1984.

Note:

Dates refer to year of assent of either the act or amendment. Very few dates of amendments are included since there are hundreds of amendments to the acts listed, and many of the amendments are minor. The short title of the act has been used in all cases. The list of legislation here is representative rather than exhaustive. Moreover, legislation concerned with the environment of the workplace or effects on human health from foods and drugs have been

excluded. At best the list should be considered as illustrative of the range and scope of Federal and Provincial legislation enacted to protect the environment and human health, and to conserve the natural resource base. The relatively recent increase in environmental legislation probably reflects the growth of concern for environmental protection rather than an introduction of a new area of jurisprudence. In many cases old laws have been amended to strengthen environmental elements, in other cases new laws have replaced earlier more limited ones, and in a few cases completely new legislation has been introduced.

Human Activity and the Environment

A Statistical Compendium

Human Activity and the Environment is a collection of environmental statistics brought together from many sources including Statistics Canada, Environment Canada and other Federal and Provincial Government Departments. The publication provides a statistical picture of Canada's physical environment while placing special emphasis on the relationship between human activities and other elements of the natural system such as the air, water, soil, plants, and animals.

Human Activity and the Environment will be useful both as a source of pertinent statistics about the environment and as a guide to the wide variety of environment statistics available in Canada.



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